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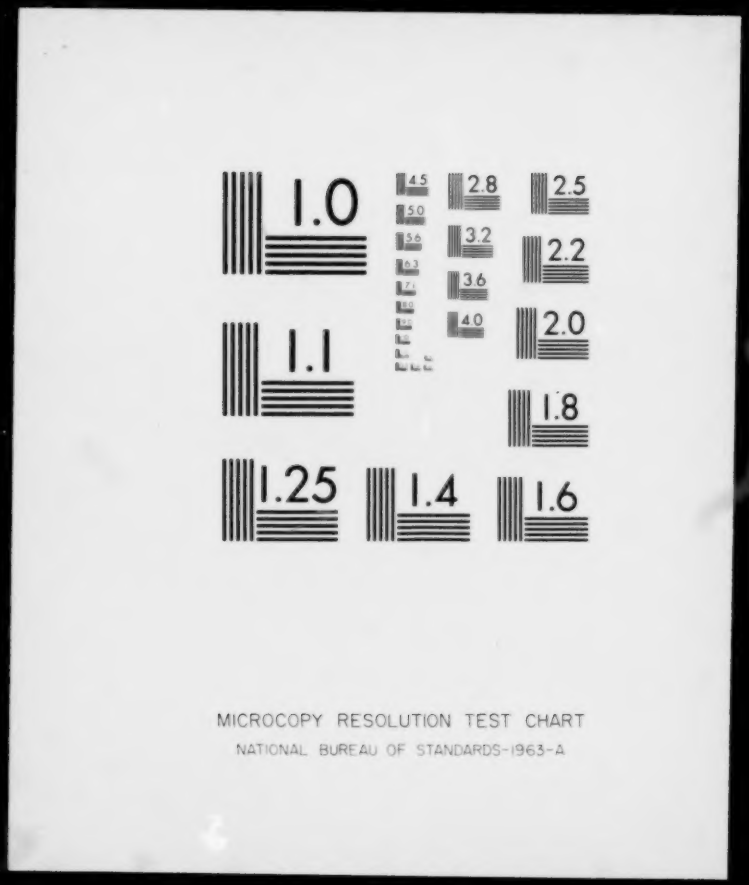

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ABSTRACT

This memorandum derives estimates of the private rate of return to schooling for men and women based on a 1965 labor force survey, past cross-sectional data, and the long-term educational public policy of Bogota, Colombia. Here resources may be viewed as an investment in the future productive capacity of people. Depending on the costs and benefits associated with a particular educational activity and alternative investment opportunities, this activity may or may not be an attractive investment for efficiently promoting economic development. This association between schooling level and earnings, or the private rate of return, along with a partial social rate are estimated for elementary, secondary, vocational, and higher education. The empirical findings state that the private and social returns on both men's and women's secondary and vocational education, and to some extent, men's primary schooling, are high in Bogota. But the returns on university education are unusually low. It is concluded, therefore, that a high economic priority should be given to the expansion of secondary and vocational education with particular emphases given to achieving a more equal distribution of educational opportunities between urban and rural, rich and poor regions of the country. Continued expansion of public support for higher education without rapid growth in domestic demand for high level talent is not likely to be remunerative, and may only accelerate emigration of universty graduates abroad. (Author/AWW)

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RM-5645-RC/AID
SEPTEMBER 1968

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RETURNS TO EDUCATION IN BOGOTA, COLOMBIA

T. P. Schultz

PREPARED FOR:
AGENCY FOR INTERNATIONAL DEVELOPMENT

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T. P. Schultz

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PREFACE

This Memorandum is part of a study of Colombia undertaken at The RAND Corporation under the sponsorship of the U.S. Agency for International Development, with supplementary funds provided by the Corporation. These interrelated investigations into the development process in Colombia seek to help AID formulate policy and establish priorities in Colombia, and at the same time illuminate a more general class of developmental problems throughout the world. This Memorandum deals with the payoff to schooling for persons in Colombia. The weaknesses of cross-sectional analyses in estimating the returns to resources allocated to the educational process are well known. However, the growing range of investigations in this area permits interesting international comparisons and provides a framework for analysis that focuses our attention on other relevant evidence while pointing the direction for further, more detailed research.

The association between schooling level and earnings was used to estimate the effect of education on the productive capacity of labor in Colombia. Empirical evidence was derived from the household-labor force survey of Bogota conducted in September 1965 by the Centro de Estudio sobre Desarrollo Economico of the Universidad de los Andes.

The author is indebted to Francisco Ortega and Miguel Urrutia of the Centro de Estudio sobre Desarrollo Economico of the Universidad de los Andes for providing access to the data collected by the Center. Comments from, and discussions with, RAND colleagues John Koehler, Barbara Woodfill, Richard Maullin, Richard Nelson, and Robert Slighton were helpful in completing this Memorandum.

SUMMARY

An important task of economics is to estimate the returns associated with various public investment activities. Resources spent on education may be viewed in these terms as an investment in the future productive capacity of people. Depending on the costs and benefits of a particular level of education, investment in education may be an effective way to promote economic development. The estimation of the rate of return to various levels of education in Colombia is the purpose of this Memorandum.

The traditional method for measuring the private benefit from the enhanced productive capacity attributed to more education overstates the private benefit. Alternative measures are explored in this study that under certain circumstances are conceptually superior to the traditional method. The private rate of return to various levels of education in Colombia are estimated using both measures of the benefit for men and women in the Bogota labor force in 1965. Though no adjustment can be undertaken to account for the social benefits of schooling that are not reflected in an individual's earnings, the average public costs of schooling per student-year can be estimated, and are added to the private costs to estimate a "partial" social rate of return to schooling in Colombia.

The empirical findings of this Memorandum are that the private and social returns to both men's and women's secondary and vocational education, and, to some extent, men's primary schooling, are high in Bogota. But the private and social returns to university education are unusually low. Other evidence from labor market interview surveys and emigration data indicate the low payoff to university training is a real problem afflicting Colombia today, but its cause may be as much cyclical stagnation as secular over-supply of high-level talent. The evidence presented here is far too limited to support detailed policy recommendations. However, the estimates of the private and social returns to resources allocated to various levels of schooling do provide some rough indication of economic policy priorities. Apparently,

high economic priority should be given to the expansion of secondary and vocational schooling, and particular emphasis might be given to achieving a more equal distribution of educational opportunities between urban and rural, rich and poor regions of the country. Continued expansion of public support for higher education without rapid growth in domestic demand for high-level talent is, on the other hand, not likely to be remunerative, and may only accelerate emigration of university graduates abroad.

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I. INTRODUCTION

To identify and to rank rewarding investment opportunities is an important but often difficult empirical task of economics. To formulate guidelines for the allocation of public investment resources requires information on both private and social returns to alternative investment opportunities. Where both private and social returns are relatively high and market imperfections are unimportant, sufficient private investment may be undertaken in socially profitable activities. Public investment resources are most in demand where the social returns exceed the private returns or where market imperfections preclude satisfactory private investment response to socially rewarding investment opportunities. The ultimate form public investment takes -- subsidies to private owner-investors, or support of public enterprises which may or may not rely on competitive pricing of their output for the purposes of distribution -- depends on the specific investment activity, the externalities related to production and comsumption, and, of course, ideological and institutional preferences and constraints. The form of public investment does not concern us here.

Resources spent on education may be viewed in this framework as an investment in the future productive capacity of people, and depending on the costs and benefits associated with a particular educational activity and alternative investment opportunities, this activity may or may not be an attractive investment for efficiently promoting economic development. In principle, the rate of return earned on resources in education can be computed in two ways, both relevant to public policy formation: A private rate of return that deals only with the costs borne and benefits received by private individuals and families, and a social rate of return that broadens the scope of inquiry to include public resources contributed to the educational system and social benefits that are not captured by private individuals but that enhance national welfare.

This Memorandum first derives estimates of the private rate of return to schooling for men and women based on a 1965 labor force

survey of Bogota, Colombia. Though no adjustment is performed to account for the social benefits of schooling, it is possible to estimate the approximate average public cost of schooling per student at various levels of the Colombian school system. These average public costs are added to the estimated private costs and "partial" social rates of return to schooling are estimated for Colombia. The social rate of return estimates are, consequently, subject to greater uncertainty than the initial estimates of the private rates of return. Moreover, all of these cost and benefit estimates are based on past cross-sectional data, and educational public policy looks to the long-term future. In the concluding section of the Memorandum, therefore, other evidence on the payoff to different kinds of education and training in Colombia is surveyed to determine whether it affirms or contradicts the primary inferences drawn from this analysis of the rates of return to schooling.

II. PRIVATE RATE OF RETURN: THE MODEL

INTRODUCTION

In search of the sources of labor's increasing productivity, economists have found that in addition to growth of factors complementing each unit of labor in production, improvement in the quality of labor appears to underlie much of the advance in labor productivity. What "the quality of labor" means is not always made clear, but it appears to denote the productive capacity of the labor input other than its quantity measured in traditional units of man-hours. One factor that is linked to labor quality is years of schooling. If schooling contributes to labor's productive capacity, the productivity attributed to schooling may be treated as a return to the costs of attending school. As with other investment activities the initial costs and the resulting additions to expected future productivity can be expressed in terms of an internal rate of return of discount rate that equates the discounted value of this net productivity profile to zero. According to this frame of analysis, forms of schooling that yield relatively high rates of return may be judged relatively effective in increasing labor's productive capacity.[1]

The association between the schooling and productivity of labor is difficult to analyze directly, for labor's product or contribution cannot be separated in most employments from that due to other productive factors. It is, thus, usual to make the classical assumption that labor's wage represents its marginal product, and moreover that the "value" of labor's product is appropriately defined as its marginal product determined by the free interaction of supply and demand. Imperfections, of course, are common in labor markets and ideological objections to this theory of value are well known. Nevertheless, a

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[1] T. W. Schultz initiated and contributed to this mode of analysis in his various works: "Investment in Human Capital," American Economic Review, Vol. 51, No. 1, March 1961; The Economic Value of Education, Columbia University Press, New York, 1963; "The Rate of Return in Allocating Investment Resources to Education," Journal of Human Resources, Vol. 2, No. 3, Summer 1967.

more useful assumption about labor market behavior or a better theory of value has yet to be developed, and with due reservations this study adopts the standard classical assumptions.

The association between schooling and earnings has been investigated in several environments and used to estimate the returns to education.[1] The objective here is to study this association in Bogota, Colombia as of September 1965. Though the derivation of rates of return to schooling is straightforward, there are conceptual and empirical issues that distinguish this analysis from others, for which there follows a word of explanation. The computed private and social rates of return are presented in the next two sections, and these empirical findings are briefly interpreted in the Colombian context in the concluding section.

Human Capital Framework

The application of capital theory to investment in people provides insights into the motivations of private allocative decisions and suggests criteria for the allocation of social investments. An investment in human capital involves the allocation of present time and resources to increase an individual's future utility. Years of formal schooling, one kind of human capital, may increase a person's utility by adding to his capacity both as a producer and consumer. The schooling may enhance his productive capacity to transform his time into earnings. Also, schooling may affect an individual's capacity to derive utility from his time and the goods purchased with his earnings. For lack of means of measurement, however, the consumer-proficiency effects of schooling on utility are generally neglected, and quantitative analysis contends only with the productive effects of schooling on utility.

The fact that schooling affects a person's productive capacity, increasing his potential earnings per hour worked, may alter his

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[1] Gary S. Becker undertook the first comprehensive analysis of income-schooling data in the United States in which he computed the rates of return to education. Human Capital, National Bureau of Economic Research, Columbia University Press, New York, 1964. Various later studies are referred to in Table 9.

allocation of time between work and leisure. In Fig. 1 an individual without schooling and with OA of non-earned income can obtain any combination of income and leisure along (or below) the lower income opportunity line. There is a family of income opportunity rays associated with various positive amounts of schooling, of which the upper line is one. There is also a set of indifference curves connecting combinations of leisure and income among which a person is indifferent, the higher indifference curves representing a higher and preferred level of utility. In this figure the person without schooling chooses point b, and the person with primary schooling point c.[1] The productive benefits from primary schooling on which a private rate of return to education may be based is the difference between utility obtained from u_2 and from u_1.

The shift from b to c may be decomposed into a substitution and an income effect, as with other changes in choice induced by a change in relative prices. Schooling increases the earnings of time relative to the price of goods, and if utility is held constant, this compensated change induces a reallocation of time from leisure to work, or from the consumption of time-intensive to good-intensive activities.[2] This substitution effect of the change in the tradeoff between the value of time and the price of goods increases both hours worked and earnings. The "real" income effect, or the change in utility, may be equated, according to Hicks, to the vertical distance (on the income axis) between the indifference curves where both curves have the slope of the initial (or final) price lines, namely DB in Fig. 1 (and the substitution effect is CD).[3] The empirical problem is how

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[1] Increments in schooling need not induce one to work, on balance, longer hours as shown in Fig. 1; the opposite might be the case, and is discussed later.

[2] G. S. Becker, "A Theory of the Allocation of Time," Economic Journal, Vol. 75, No. 299, September 1965.

[3] J. R. Hicks, Value and Capital, Oxford at the Clarendon Press, 1939, pp. 31-32.

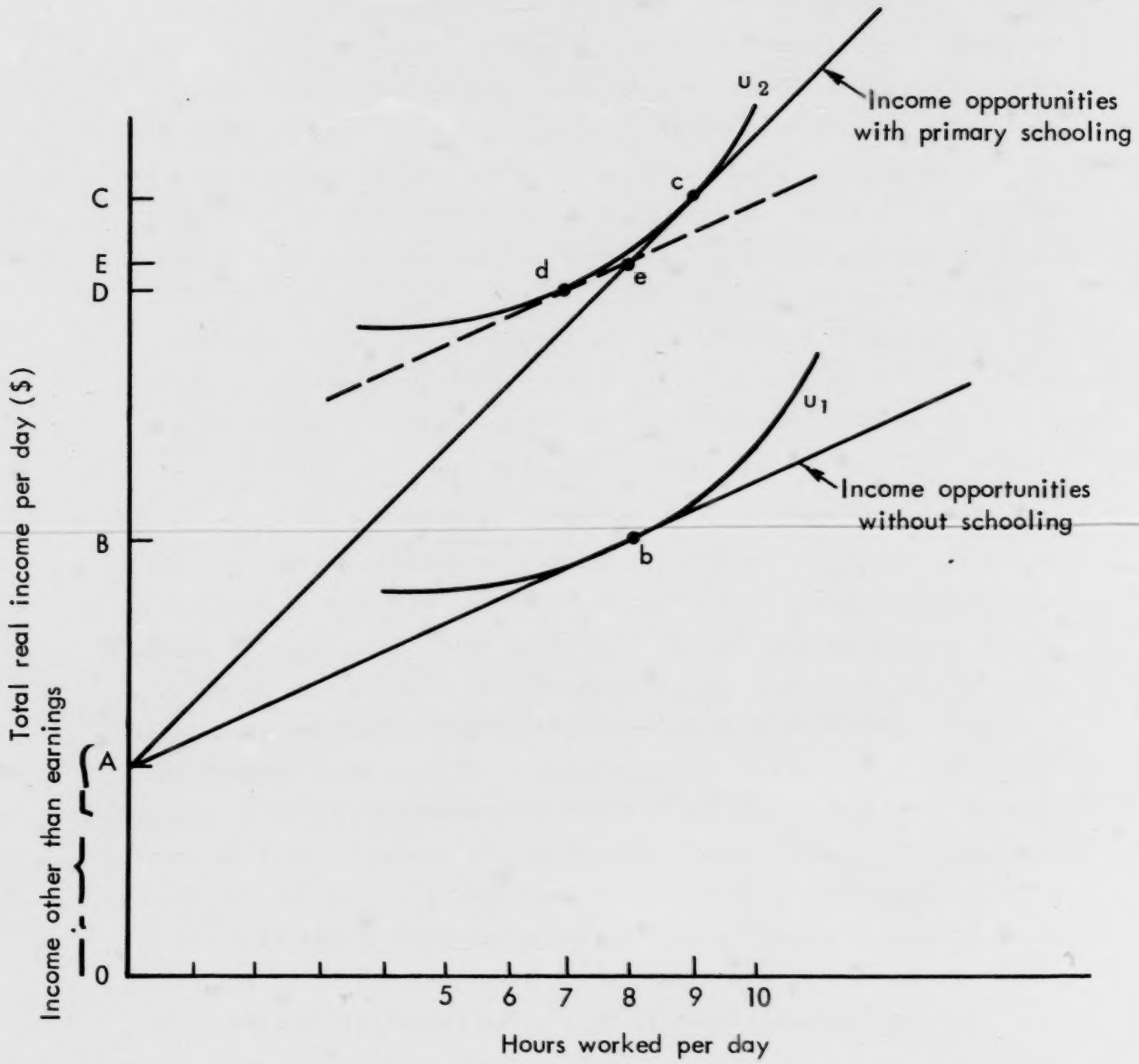

Fig. 1—Income and substitution effects of a change in labor's productive capacity due to schooling

to approximate the Hick's income effect since the slope of the indifference curves is observed only at points b and c.

There are two readily observed measures of earned income, the amount earned per week (month, year, and so on) and the amount earned per hour worked. The reliable direction of the substitution effect implies that changes in weekly earnings always overstate the "real" income effect associated with increased schooling, for they include the substitution effect. It can be shown, furthermore, that if the consumption of time in leisure activities is a superior "good" and schooling induces one, on balance, to work longer hours per week, then the change in hourly earnings is a better approximation of the income effect than the change in weekly earnings. However, if leisure is a superior activity but schooling induces one to work less, the change in weekly earnings overstates the "real" income effect of schooling less than the change in hourly earnings. Finally, if leisure is an inferior "good," the changes in weekly and hourly earnings associated with schooling bracket the "real" income effect, and it is not clear in this case whether weekly or hourly earnings is a better approximation for the "real" income effect.[1]

THE MODEL

Let the productive capacity of a person's time be a function of his age, schooling, and other factors such as vocational training, job experience, and talent. Assume wages correspond to (marginal) labor productivity. The difference between earnings streams expected by individuals with and without attending school, other things being

[1]Figure 1 is an example of the first case where leisure is superior (income effect on hours worked in negative) and schooling induces one to work more hours and geometrically, weekly earnings equals BC, hourly earnings BE, and the "real" income effect BD. It can be seen in this case the BC > BE > BD. In the second case, where leisure is superior but hours worked declines with schooling, the inequalities change to the following: BE > BC > BD. In the third case where leisure is inferior (positive income effect), BC > BD > BE. Clearly if hours worked do not change (leisure being superior), hourly and weekly earnings change in the same proportion and overstate equally the "real" income effect.

equal, may be attributed to the productive effect of schooling. Earnings are measured both on a weekly and hourly basis to obtain more information on the magnitude of the "real" income effect associated with schooling. Call this difference in earnings D_{ij}, where i represents the marginal level of schooling attained and j the time elapsed from the moment this level of schooling began. Initially these earnings differences tend to be negative when the opportunity to work and earn income is forgone and direct costs of schooling are incurred, and eventually they are non-negative when completed schooling enhances the productive capacity of labor's time. The marginal private internal rate of return, r_i, to the ith level of schooling is determined by the formula:

$$0 = \sum_{j=1}^{j=n} (1 + r_i)^{-j} D_{ij} \qquad (1)$$

where n years after the start of the ith level of schooling one stops working. To estimate the internal rate of return to schooling, one must estimate the costs and expected earnings differences attributable to various marginal increments in schooling for otherwise homogeneous groups of individuals.

Estimates of the private rate of return to schooling do not generally confront the interactions between schooling and an individual's work-leisure allocation of time. Prior studies analyze annual earnings or even annual income data, and do not alert one to the upward bias in their return estimates, nor seek to estimate the limits to this bias by parallel treatment of hourly earnings data.[1] The dual

[1]Annual labor productivity, when schooling is held constant, may not vary in exact proportion to hours worked, for biological factors probably drive down the marginal contribution of labor after some sufficiently large number of hours has been worked per day. Denison has ventured the judgment that over time the reduction in hours worked per year contributes to a partly offsetting increase in labor productivity per hour. In the United States from 1929 to 1957, labor hours worked declined 18.2 percent, but according to Denison the productivity of labor per year decreased by only 6.0 percent in comparison with what it would have been had hours worked per year not changed. The compensating tradeoff between hours worked per year and productivity per hour

analysis undertaken here of both hourly and weekly earnings implicitly assumes that people select the number of hours they want to work and to devote to leisure activities independently of their educational attainment, and that the disutility of their work opportunities is unaltered by their schooling.[1] Neither of these assumptions can be defended as realistic, but empirical work needed to formulate more realistic assumptions and quantify them has not yet been undertaken.

Cross-sectional Data

For private and social decisions on allocating time and resources to various levels of education, one wants information about the expected future age-earnings profiles for those about to enter the educational system. Data and methods, however, are not now available for estimating these expected time-series profiles of earnings. Nor are data on past earnings available for deriving ex post the actual rates of return earned on the schooling of individuals now about to retire from the labor force. The lack of time-series data on earnings compels us to rely on cross-sectional data, though it should be clear that they measure very different relationships than those ideally sought for current decisionmaking. All changes that have or will be made over time are ignored in the cross-sectional relationship between age, schooling, and earnings. Two factors may be emphasized.

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would probably by lower in a cross-section of competing individuals than among temporally non-competing groups of individuals (time-series). Edward F. Denison, The Sources of Economic Growth in the United States and the Alternatives Before Us, Supplementary Paper No. 13, Committee for Economic Development, New York, January 1962, p. 40.

[1]More precisely, the private rate of return should be based on a measure of earnings per hour where the satisfaction of disutility of hours worked is held constant. How else is one to interpret an individual working for an advanced degree with which he gains the option to take a lower paying (per hour) job? Although the adjustment of hourly earnings for the agreeableness of work cannot be empirically pursued with available data, it suggests a serious further shortcoming of existing estimates of the private rate of return to schooling. These conclusions emerge directly from Adam Smith's classic, Wealth of Nations, Book I, Chapter 10, Edwin Cannan (ed.), University Paperbacks, Methuen, London, 1961.

First, the quality and character of schooling may change as may the relevance of schooling to production and career advancement. In Colombia, for example, there is evidence that for the older generation of businessmen formal education was not a prerequisite to advancement and success. This situation appears to be changing; the younger generation benefits greatly from attaining a university degree, particularly from the best schools. This characterization of the changing value of higher education in the Colombian labor market may have its counterpart in other countries, and suggests that future earnings profiles of the university trained may be relatively higher compared with those of secondary school graduates than they were in the past.[1]

Second, secular growth in per capita output benefits most people to some extent. Per capita real income has risen in Colombia since early benchmark years in the 1930s, and despite recent setbacks in the coffee price, this upward trend in average personal income is likely to continue. One cannot predict a priori how this biases differences among schooling groups in cross-sectional earnings data, but it is likely that the returns from cross-sectional data understate the returns derived from future time series.

Adjustment of Hourly Earnings

The conditions of unemployment and underemployment of labor, though they do not fit exactly in the competitive framework, require explicit consideration in this study. If earnings were measured over an individual's lifetime, periods of unemployment would be averaged into periods of employment and divided by some measure of effort expended in working and in search of work.[2] But when the period of observation is short, some individuals have neither job nor earnings though they are in search of employment. They are defined as

[1]Robert L. Slighton, Relative Wages, Skill Shortages, and Changes in Income Distribution in Urban Colombia, RM-5651-AID, The RAND Corporation (forthcoming).

[2]More precisely, some benefit should probably be imputed to the leisure enjoyed while a person is unable to find a job.

unemployed.[1] The longer the interval over which earnings are measured (averaged), the smaller tends to be the variance within a group since unemployment is often distributed more evenly across the labor force over a lifetime. Since data on weekly earnings were collected in Bogota, and more than one-tenth of the labor force is unemployed, the relative variance in individual earnings in the sample survey is larger than that found in most studies based on annual earnings.

Underemployment raises still more complex problems, for conceptually one wants to measure earnings per hour for all individuals where they have freely divided their time between work and leisure. If an individual works less than the average in Bogota of 48 hours per week, and actively looks for more employment, his hourly earnings probably overstate his realized productivity since he works less than he wants at the available wage. In this case, we define an adjusted hourly wage as his weekly earnings divided by 48, the number of hours worked on the average per week in manufacturing, which we assume he also wants to work. Less than two percent of the work force falls in this category of underemployed.[2]

The above adjustment for underemployment is performed only when an individual looks for additional hours of employment. How then is one to interpret individuals who do not seek employment because the going wage for their services is too low? Unless participation rates are uniform across all educational classes it may be argued that education has influenced economic activity rates of indirectly enhanced opportunity earnings of the better educated, which has influenced their balance of work-leisure. Since it is not possible to measure the opportunity earnings persons forgo who remain outside of the paid labor force, we cannot answer the question as to how representative the labor

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[1]The dependent variable of the later regression analysis is the logarithm of earnings, and thus a nominal positive earnings must be attributed to the unemployed.

[2]See the last row of Table 1.

force is of the total population in a particular age, sex, and schooling class. Among men, participation is uniformly high from age 20 to age 60, but for women who are in the labor force far less frequently and less regularly throughout their lives, it is hard to predict how different participation patterns among various age-education classes alter the computed rates of return to schooling based only on the active labor force. Neglect of differences in female participation rates assumes that women not in the paid labor force contribute equally to household resources as those of comparable age and education who are in the paid labor force, and thus the participants are representative in productive capacity of all women of the same age and schooling in Bogota.

Labor earnings are measured in the survey in money terms, omitting all earnings in kind. For many workers fringe benefits in kind constitute an important source of real earnings, but for domestic servants, earnings in kind are their major remuneration. Domestic servants living in the home of their employers receive room, board, and necessities in addition to their money wages, and are required to be available for work most of their waking hours six days a week. Though domestic servants represent a negligible portion of the male labor force, they are about one-fourth of the female labor force in Bogota. To gauge the effect on our rate of return estimate of understating the real earnings of domestic servants, a second rate of return is calculated based on an adjusted wage, defined as three times reported weekly money income of this group of workers divided by 48, plus one-half of the hours reported in excess of 48 hours worked per week.[1]

These results neglect mortality. All individuals do not live to derive all the years of benefits from their investment in schooling, and hence the level of mortality slightly depresses the true rates of

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[1]This adjustment is not based on scientifically gathered evidence, but casual empiricism suggests that this three to one differential was appropriate in Bogota in 1966-1967. The 48 hour week is the average reported in manufacturing and corresponds approximately to the time domestic servants were said to work per week in the average Bogota home, though they were obviously in residence more than 48 hours per week.

of return to investment in human capital.[1] Also, the trend toward decreasing death rates increases the likelihood that the average individual will live out his economically active years, and thus promises the younger generation a better chance than the older generation to recoup the costs of their education, other things being equal. Although evidence is not yet conclusive, it appears that educational attainment contributes to increased longevity or lower incidence of mortality. If this were true in Colombia, differential mortality would tend to raise the rates of return on schooling slightly.

Because of the great variance on participation patterns beyond the age of 65, earnings differentials attributed to schooling are not projected beyond age 65, at which time it is assumed all persons retire. Regardless of this assumption, the present discounted value of these earnings late in life are likely to be of little importance in determining the rate of return.

Explanatory Variables in the Model

Earnings for each sex are postulated to be a linear function of age, schooling, and other factors. A variety of other factors might be considered relevant to the determination of individual earnings, but this study deals with only two: family income other than that earned by the respondent, and the number of years since the individual left his birthplace (proxy for years in Bogota). First, it may be hypothesized that other sources of income within the family may reduce the incentive for the respondent to earn income in comparison with colleagues of similar age and schooling.[2] Second, it is a widespread belief that the migrant to a rapidly growing city like Bogota is at a substantial disadvantage in securing a job commensurate with his

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[1] Applying age and sex specific mortality rates estimated for the entire Colombian population (which undoubtedly exceed those applicable to Bogota) reduces the annual rate of return to primary male schooling from 18.6 to 17.8 percent. With higher levels of education the effect is smaller. See Table 7.

[2] Family income is equal to household income less the respondent's own earnings, except where the respondent is a domestic servant or lodger in the household, in which case his family income is assumed to

abilities.[1] The question investigated here is whether the worker born in Bogota fares better in the Bogota labor market than does the migrant of equal age and schooling.

Age is included in the estimation of earnings by means of six dummy variables that are equal to 1 if the individual falls in a specific age cohort, and 0 if not. The age dummies are defined on the cohorts 20-24, 25-34, 35-44, 45-54, 55-64, and 65 or older. The overall constant term represents the age dummy for the residual cohort less than 20 years of age.[2]

Schooling variables represent a hybrid of dummy and scaled variables. A variable for each level of schooling -- primary, secondary, university, and vocational -- specifies the number of years completed. This specification of the schooling variables implies that each year of schooling has equal effect on earnings. Although evidence from other studies suggests that the concluding years of each level of schooling tends to pay a higher return than intermediate ones, our specification is not likely to bias our estimates much. On the other

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be negligible or equal to one peso per week. It is possible that some domestic servants see their children on weekends, and may derive some additional earnings from then, but this seems doubtful, since these additional earnings would probably not cover the costs of child care among her relatives. If the family is defined as the extended unit the financial resources are not at her disposal, though they might help support her children. This is only an approximate adjustment for which domestic servants had to be excluded.

[1]Several specifications of the migrant resident variable are tried. First, years since departure from birthplace is used, and then the logarithm of years. It seemed plausible that the better educated would suffer less discrimination in Bogota than would the less educated migrant, so finally a variable is defined as the logarithm of years since departure from birthplace divided by years of schooling.

[2]An additional dummy variable for the cohort aged 15-19 was first introduced in the estimation equation, but its insignificant coefficient led us to assume that there was no statistically significant difference in earnings received by those few respondents between the ages of 10 and 14 and those received by respondents between the ages of 15 and 19. The inclusion or exclusion of this seventh age dummy variable did not substantially affect the other coefficients.

hand, since vocational and university schooling may consist of courses of different duration, there is no way to determine whether the individual graduated from the university after five or six or seven years. By arbitrarily assuming that each year completed affects earnings equally, the university can be assumed to represent five years and vocational schooling three years, and thus we can construct earnings-age profiles to discount against the costs of five and three years of higher education. Vocational schooling, however, is quite heterogeneous including normal school, secretarial school, commercial school, and other types of formal vocational training. Since most vocational training programs require no more than a primary school certificate, it is assumed that vocational schooling adds to a primary education. For these reasons, the rates of return to vocational education should be interpreted with extreme caution. As with the age dummies, persons with no schooling fall under the overall constant term.

The dependent variable in the estimation equation may be taken as either absolute earnings or logarithm of earnings, depending on whether the effect of age and schooling on earnings is thought to be more nearly absolute or proportionate. It is not surprising that this study finds, as others have, that the logarithmic formulation of the estimation equation is preferable. The linear approximation of the earnings function can then be expressed symbolically.

$$\text{Log } Y = \beta_1 + \sum_{j=1}^{4} \beta_{2j} S_j + \sum_{i=1}^{6} \beta_{3i} A_i + \beta_4 R + \beta_5 F + \mu \qquad (2)$$

where

Y is an individual's earnings,

S_j is the years of schooling in the jth level completed where $j = 1,\ldots,4$,

A_i is an age dummy for $i = 1,\ldots,6$,

R is a proxy for years of residence in Bogota,

F is the other sources of family income,

μ is a properly behaved disturbance term,

and the β's are parameters to be estimated by ordinary least square procedures.

III. PRIVATE RATE OF RETURN: THE EVIDENCE

REGRESSION RESULTS

The empirical evidence is based on the household labor force survey of Bogota conducted in September 1965 by the Centro de Estudios sobre Desarrollo Economico of the Universidad de los Andes, Bogota. In his study of unemployment in Colombia, Robert Slighton has dealt with the strengths and shortcomings of these survey data.[1] A sample of 684 men and 316 women, ten years old or over, was selected from the survey responses, including all persons working or in search of work in the survey week and answering the questions relevant to this study.[2] It is not known how to determine whether this selection process biases our sample. The age, schooling, and employment status of the sample is summarized by sex in Table 1.

Earnings functions are estimated for men and women in the form suggested in Eq. (2), and subsequently marginal variables are excluded that are not found to be associated with the dependent variable, earnings. The ordinary least squares estimates and their "t" statistics are shown in Tables 2 and 3. Weekly earnings are used as dependent variables for comparison, but in general hours worked are held constant for computing a private rate of return to schooling, and our interpretation focuses mainly on this hourly earnings estimate.

Adjustment of hourly earnings for underemployment and the character of domestic service occupations is unimportant for men but substantially affects the estimates for women's earnings. Although other

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[1] Urban Employment in Colombia: Measurement, Characteristics, and Policy Problems, RM-5393-AID, The RAND Corporation, January 1968.

[2] Those questions were age, age left native city for good, respondent's income, family income, hours worked, and period of unemployment. These requirements in editing the sample reduced the male sample 5.3 percent from 722 to 684, and the female sample 16.2 percent from 377 to 316. A number of additional checks on the consistency of answers with regard to income, age, migration, employment status, and schooling completed did not uncover any contradictions in answers. In comparison with most labor force data available from less developed countries, these survey data appear reliable and carefully collected.

Table 1

CHARACTERISTICS OF BOGOTA ECONOMICALLY ACTIVE SAMPLE: AGE, SCHOOLING, AND EMPLOYMENT STATUS

	Men	Women
Age cohorts (in percent of total)		
10-14	.57	3.16
15-19	10.97	22.15
20-24	13.16	25.00
25-34	26.61	25.95
35-44	24.71	12.98
45-54	15.35	5.38
55-64	6.43	3.80
65 or over	1.75	1.58
Mean years of schooling (in years completed per person)		
Primary	4.086	3.497
Secondary	1.563	.981
University	.368	.155
Vocational[a]	.091	.434
Employment status (in percent of economically active)		
Completely unemployed	10.6	12.9
Looking for more work	1.1	2.8

Note:

[a]Vocational education includes secretarial training, commercial school, vocational school, normal school, and other types of formal training.

Table 2

REGRESSION RESULTS ON MALE EARNINGS:
BOGOTA ECONOMICALLY ACTIVE MEN, SEPTEMBER 1965
(beneath each regression coefficient is its "t" statistic)

Dependent Variable	Constant	Years of Schooling				Age Cohorts						R^2
		Primary	Secondary	University	Vocational	20-24	25-34	35-44	45-54	55-64	65 or more	
Log earnings[a]	-.9309	.0500	.0785	.0475	.0406	.4747	.7718	.9016	.8382	.6292	.6064	.259
		(2.5)	(5.3)	(2.0)	(.9)	(4.4)	(8.1)	(9.4)	(8.0)	(4.7)	(2.8)	
Log wage[b]	-.6793	.0469	.0893	.0566	.0482	.4869	.7994	.9298	.8374	.6360	.6428	.238
		(2.1	(5.3)	(2.1)	(.9)	(4.0)	(7.4)	(8.6)	(7.1)	(4.2)	(2.6)	
Log adjusted wage[b]	-.6796	.0473	.0889	.0548	.0489	.4863	.8029	.9238	.8346	.6366	.6422	.236
		(2.1)	(5.3)	(2.1)	(.9)	(4.0)	(7.5)	(8.5)	(7.0)	(4.3)	(2.6)	

Notes:

[a] Hundred pesos per week.

[b] Pesos per hour.

Table 3

REGRESSION RESULTS ON FEMALE EARNINGS: BOGOTA ECONOMICALLY ACTIVE WOMEN, SEPTEMBER 1965

(beneath each regression coefficient is its "t" statistic)

Dependent Variable	Years of Schooling					Age Cohorts						Family Income	R^2
	Constant	Primary	Secondary	University	Vocational	20-24	25-34	35-44	45-54	55-64	65 or more		
Log Earnings[a]	-.7984	.0038	.0778	.1172	.1102	.2680	.4669	.5082	.4784	.3239	.5119		.209
		(.2)	(3.1)	(2.4)	(3.2)	(2.3)	(4.2)	(3.8)	(2.6)	(1.5)	(1.6)		
Log Wage[b]	-.6418	.0035	.0877	.1195	.1224	.3494	.5643	.6297	.7756	.4374	.6105		.216
		(.1)	(3.1)	(2.2)	(3.1)	(2.6)	(4.4)	(4.1)	(3.6)	(1.7)	(1.7)		
Log Adjusted Wage[b]	-.1701	-.0526	.0809	.1203	.1159	.2137	.4107	.4107	.4218	.2787	.4183		.129
		(-1.8)	(2.7)	(2.1)	(2.8)	(1.5)	(3.1)	(2.6)	(1.9)	(1.1)	(1.1)		
Log Earnings[a]	-.9173	.0190	.0831	.1247	.1127	.3000	.4959	.5419	.4941	.3416	.5156	-.0636	.216
		(.7)	(3.3)	(2.6)	(3.3)	(2.6)	(4.4)	(4.0)	(2.7)	(1.6)	(1.6)	(-1.7)	
Log Wage[b]	-.7311	.0149	.0916	.1252	.1242	.3734	.5680	.6551	.7875	.4507	.6132	-.0478	.219
		(.5)	(3.2)	(2.3)	(3.1)	(2.8)	(4.6)	(4.2)	(3.7)	(1.8)	(1.7)	(-1.1)	
Log Adjusted Wage[b]	-.4666	-.0147	.0939	.1391	.1220	.2935	.4828	.4948	.4610	.3228	.4274	-.1587	.165
		(-.5)	(3.2)	(2.5)	(3.0)	(2.1)	(3.7)	(3.1)	(2.1)	(1.3)	(1.1)	(-3.6)	
Log Earnings[a]	-.7878		.0792	.1171	.1115	.2702	.4687	.5091	.4788	.3190	.5128		.209
			(3.4)	(2.4)	(3.3)	(2.3)	(4.2)	(3.8)	(2.6)	(1.5)	(1.6)		
Log Wage[b]	-.6322		.0889	.1195	.1235	.3514	.5659	.6306	.7759	.4330	.6113		.216
			(3.3)	(2.2)	(3.2)	(2.7)	(4.5)	(4.1)	(3.7)	(1.8)	(1.7)		
Log Adjusted Wage[b]	-.3158		.0625	.1212	.0991	.1834	.3872	.3980	.4172	.3459	.4061		.120
			(2.2)	(2.1)	(2.5)	(1.3)	(2.9)	(2.5)	(1.9)	(1.3)	(1.1)		
Log Adjusted Wage[b]	-.5134		.0800	.1402	.1182	.2898	.4804	.4956	.4617	.3414	.4248	-.1662	.165
			(3.2)	(2.5)	(3.0)	(2.1)	(3.7)	(3.1)	(2.1)	(1.4)	(1.1)	(-4.0)	

Notes:

[a]Hundred pesos per week.

[b]Pesos per hour.

income of the household-family unit is not associated with men's earnings to any distinguishable extent, for women family income appears to have the expected disincentive effect on her earnings, when age and schooling are held constant. In neither case was a significant association found between our measure for duration of residence in Bogota and earnings, and indeed various specifications of this variable yielded regression coefficients of vacillating sign.[1]

In the case of men, only the vocational schooling variable fails to satisfy standard levels of statistical significance, but since its coefficient is reasonable and stable for all regressions in Table 2, it is included in the wage estimates derived in the next section although it should be interpreted with caution. All age dummies are satisfactory for men, and conform to the usual pattern of rising sharply in the younger years, peaking between 40 and 50, and declining thereafter. Because of the unrepresentative character of the group of men working after age 65, there is no need to explain why earnings should rise somewhat between the last two age cohorts. Because of the additive character of our age and schooling dummy estimates, the age-earnings profiles for all education levels have a common shape.[2]

Among women there is no evidence, however earnings are measured or adjusted, that earnings are affected by years of primary schooling completed. Those who demand the services of domestic servants and other unskilled female labor in Bogota appear to place little market value on primary schooling. This is more easily understood when it is realized that primary school standards differ greatly between Bogota and the surrounding countryside, and from region to region in Colombia. Outside of Bogota, this phenomenon may not exist, but for estimating the earnings functions for women in Bogota, the primary schooling

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[1] See p. 14, fn. 1, for alternative specifications of the Bogota residence proxy variable.

[2] It has generally been found that the age-earnings profiles from cross-sectional data reveal a later peak for groups with more education. See Giora Hanock, "An Economic Analysis of Earning and Schooling," Journal of Human Resources, Vol. II, No. 3, Summer 1967, Table 2, pp. 316-317.

variable is omitted and no rate of return is computed to primary schooling. Schooling for women beyond the primary level, however, is associated with significantly increased earnings. The age dummies for women are of the expected pattern, and almost without exception the age dummies are statistically significant until age 55, when the age cohorts of women in our sample who are still in the labor force are very small (see Tables 1 and A-7).

These regression findings support several hypotheses. Age and schooling have well defined associations with earnings in Bogota, except for men's vocational and women's primary schooling. The period of residence in Bogota does not appear to be associated with earnings when age and schooling are held constant. These data provide no support for the hypothesis that migrants suffer unduly in Bogota's labor market. Further analysis confirms our findings, for unemployment and underemployment are less frequent among recent migrants to Bogota than among those born in Bogota.[1] Sources of family income other than the respondent's earnings appear to have a disincentive effect on women's earnings but no distinguishable effect on men's. For illustrative purposes, the regression estimates are used to derive hourly earnings profiles for men and women by age and schooling, and these are shown in Fig. 2 and Tables 4, 5, and A-1 through A-3.

A weakness of the procedure used here to estimate the age-earnings profiles explains some unusual aspects of these estimates. The age-log earnings profile is estimated for the entire sample of each sex, allowing for schooling to shift the relative earnings profile up or down. Since most of the sample has little schooling the unweighted least squares estimates of the age-log earnings profile is more appropriate for those who have completed the average years of schooling rather than those few who have completed university training. Consequently, the estimated peak in male earnings between the ages of 35 and 44 may be accurate for the average worker, but is probably too young for the university graduate. Among women, the rise in earnings

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[1] R. L. Slighton, RM-5393-AID, Table 14, p. 38.

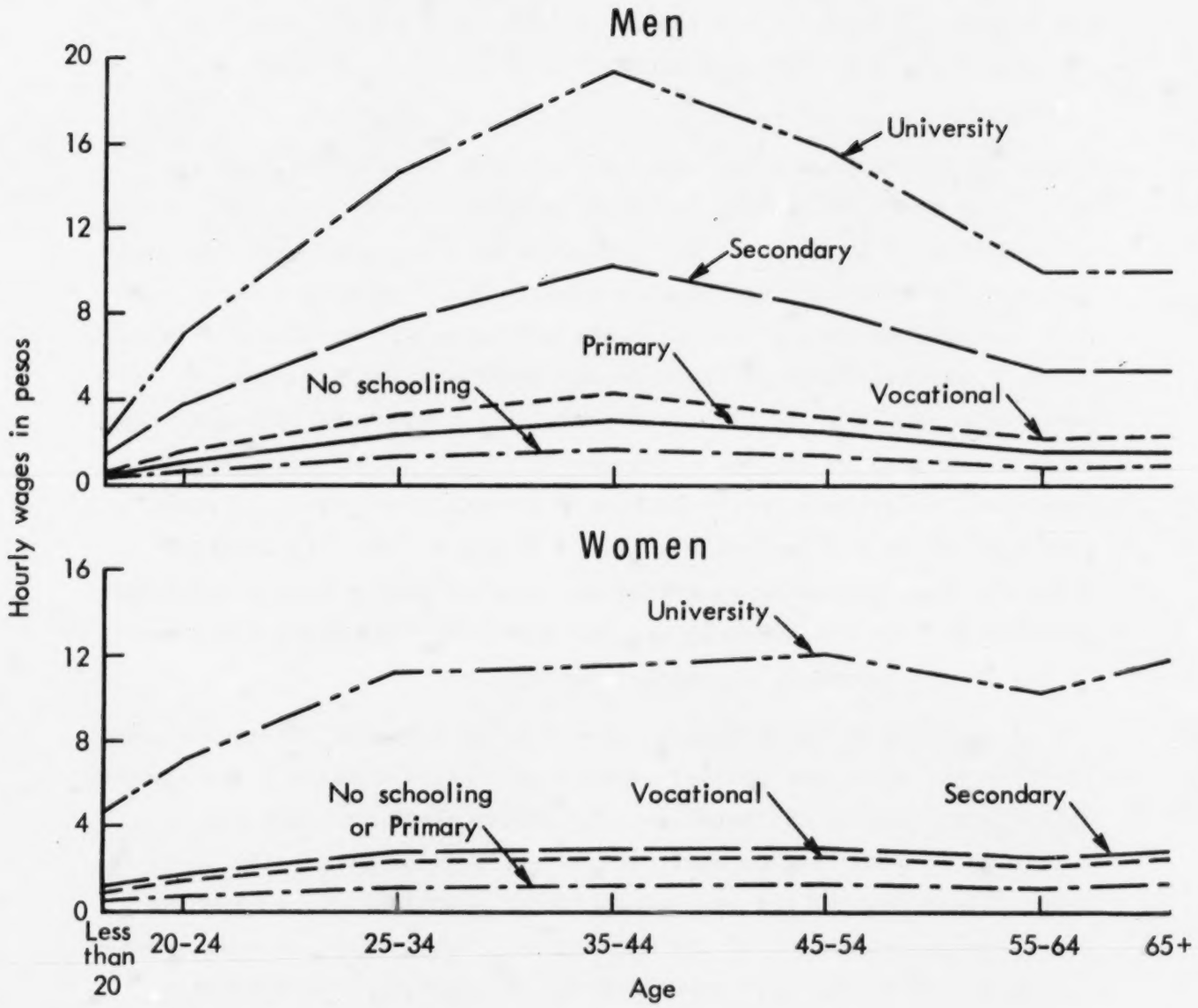

Fig. 2—Estimated adjusted wages of men and women by age and schooling: Bogota September 1965

Table 4

ESTIMATED ADJUSTED MALE WAGE BY AGE AND SCHOOLING:
BOGOTA, SEPTEMBER 1965[a]

(pesos per hour)

Synthetic Graduate by Education Type (and Years of Schooling)	Age Cohort						
	19 or less	20-24	25-34	35-44	45-54	55-64	65 or more
None (0)	.21	.64	1.33	1.75	1.43	.91	.92
Primary (5)	.36	1.10	2.29	3.02	2.46	1.56	1.58
Secondary (11)	1.23	3.77	7.82	10.33	8.41	5.33	5.40
University (16)	2.31	7.09	14.70	19.41	15.81	10.02	10.15
Vocational (8)	.51	1.55	3.21	4.24	3.45	2.19	2.22

Note:

[a]Adjustments discussed in text.

Source:

Table 2, regression 3.

Table 5

ESTIMATED ADJUSTED FEMALE WAGES BY AGE AND SCHOOLING: BOGOTA, SEPTEMBER 1965

(pesos per hour)

Synthetic Graduate by Education Type (and Years of Schooling)	Age Cohort						
	Less than 20	20-24	25-34	35-44	45-54	55-64	65 or more
None (0) Primary (5)	.48	.74	1.18	1.21	1.26	1.07	1.23
Secondary (11)	1.15	1.75	2.80	2.87	3.00	2.54	2.92
University (16)	4.63	7.06	11.28	11.57	12.09	10.26	11.78
Vocational (8)	.96	1.46	2.34	2.40	2.50	2.13	2.44

Note:

[a]Adjustments discussed in text.

Source:

Table 3, regression 9.

profile is more moderate, as one would expect from other analyses, and reaches its peak between the ages of 35 and 54, depending on the regression (regressions 7 through 10, Table 3). If the sample were larger, age-earnings profiles could be estimated separately for each level of schooling.[1]

PRIVATE COSTS OF SCHOOLING

Private student costs include both direct costs associated with attending school and opportunity costs associated with earnings forgone by the student while attending school rather than working. Direct private costs of schooling in Colombia are derived from a study by Guillermo Franco Comacho, based on a sample survey of 2,680 family units collected throughout Colombia in 1961-1962.[2] Between the time of Franco's survey and the CEDE survey used in this study the Bogota consumer price index increased about 63 percent. The direct private costs estimates of schooling used in Table 6 are Franco's estimates inflated by the Bogota price index and smoothed to remove implausible year-to-year variations. The original Franco cost estimates are summarized in Appendix Table A-4.[3] Estimates of the private opportunity costs of schooling shown in Table 6 are derived from the adjusted wage estimates in Tables 4 and 5, but much uncertainty surrounds this component. For example, do primary school aged children have the opportunity to earn some (or more) income if they do not attend school, and what proportion of adolescents and university students hold a job, part-time or part-year, while they continue their

[1] As Hanoch has done with U.S. Census data in "An Economic Analysis of Earning and Schooling."

[2] Rendimiento de la Inversion en Educacion en Colombia, Centro de Estudios sobre Desarrollo Economico, Universidad de los Andes, Bogota, Colombia, July 1964.

[3] Franco's estimates of earnings and the opportunity costs of schooling differ systematically from those collected four years later in the CEDE survey. This may stem partly from changes in relative wages but probably more important is our method for holding constant the number of hours worked (at 2400 hours per year) and adjusting earnings for income in kind received by domestic servants.

Table 6

ESTIMATED COST OF SCHOOLING IN BOGOTA
(in pesos of September 1965)

Years of Schooling	Assumed Age	Direct Costs		Opportunity Costs[a]		Total Costs of Schooling	
		Male	Female	Male	Female	Male	Female
Primary							
1	9	633	536			633	536
2	10	689	616			689	616
3	11	750	708			750	708
4	12	816	815			816	813
5	13	888	934			888	934
Secondary (both courses)							
1	14	954	1016	442	887	1396	1903
2	15	1025	1105	553	968	1578	2073
3	16	1101	1202	691	1056	1792	2258
4	17	1181	1305	864	1152	2045	2457
5	18	1286	1372	1080	1256	2366	2628
6	19	1400	1443	1350	1370	2750	2813
University							
1	20	1524	1517	2759	2506	4283	4023
2	21	1659	1595	4567	3280	6223	4875
3	22	1804	1677	5856	4200	7660	5877
4	23	1964	1763	6298	4404	8262	6167
5	24	2138	1854	6777	4618	8915	6472
Vocational							
1	14	1510	1432	2759	2506	4269	3938
2	15	1707	1620	4567	3280	6274	4900
3	16	1903	1811	5856	4200	7759	6011

Note:

[a] It is assumed that no opportunity costs are associated with primary school attendance.

studies? Because of these possible sources of error in the estimation of the private opportunity costs of schooling, a high and low alternative set of opportunity cost estimates are analyzed.[1]

The Private Internal Rate of Return to Schooling

Using these costs of schooling and wage profiles, private rates of return are computed that equate the discounted value of these costs and implied benefits of future increased earnings to zero.[2] The first part of Table 7 shows these rates of return for men and women, using weekly earnings, hourly earnings, and adjusted hourly earnings. Since students may work part-time while attending school, or alternatively command better paying jobs than those who did not continue in school, the exact opportunity cost of schooling to students may vary substantially from those estimated in Table 6. Consequently, the rates of return to various levels of schooling are recomputed assuming that opportunity costs are, alternatively, much higher and much lower than those reported in Table 6. These rates of return based on alternative levels of opportunity costs are calculated only for the adjusted hourly wage measure of earnings and are presented in the second portion of Table 7.

First, the ranking of rates of return does not change regardless of concept of earnings or level of opportunity costs used. For men, primary school yields a 17 to 20 percent return, secondary school yields 29 to 38 percent, university yields 4 to 5 percent, and vocational training yields approximately a 50 percent rate of return on costs. For women, secondary school yields 14 to 21 percent, university 4 to 6 percent, and vocational training about 50 percent rate of return on costs. These estimates imply that there are large payoffs to secondary and vocational schooling for both men and women and relatively small ones to university studies. Primary schooling is remunerative

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[1] These alternative cost estimates are described in Table 7.

[2] See Eq. (1).

Table 7

PRIVATE INTERNAL RATES OF RETURN TO SCHOOLING IN BOGOTA, 1965

	Primary Over No Schooling	Secondary Over Primary	Vocational Over Primary	University Over Secondary
I. COSTS OF EDUCATION AS GIVEN IN TABLE 9				
Men -- Based on:				
Weekly earnings	20.5	33.2	49.4	4.1
Hourly wage	18.2	34.4	51.6	4.5
Adjusted wage	18.4	34.3	52.5	4.4
Women -- Based on:				
Weekly earnings	a	18.4	53.9	5.1
Hourly wage	a	18.9	52.9	5.3
Adjusted wage	a	16.0	54.7	5.1
Adjusted wage with family income held constant at 100 pesos per week	a	17.8	54.2	5.5
II. ALTERNATIVE ASSUMPTIONS ON THE LEVEL OF OPPORTUNITY COSTS				
Men				
Adjusted Wage Basis				
High opportunity costs[b]	16.7	28.8	42.8	3.6
Low opportunity costs[c]	18.4	38.3	59.1	5.2
Women				
Adjusted Wage Basis				
High opportunity costs[b]	a	13.6	41.6	4.6
Low opportunity costs[c]	a	21.1	63.8	6.2

Notes:

[a] No association observed between years of primary school completed and women's earnings. Consequently, with some costs involved in primary education and no benefits, the implied rate of return is negative and infinitely large on this investment in schooling.

[b] Opportunity costs for primary education assumed to rise from 100 pesos per year at age 9 to 200 pesos per year at age 13. Opportunity costs for Secondary, Vocational, and University education are double those in Table 3.

[c] Opportunity costs for all levels of education assumed to be one-half those in Table 3.

to men, but given the peculiar nature of the labor market for female skills, women are rewarded only if they continue into secondary or vocational school. Vocational training, in its diverse forms, appears to reward men and women about equally for their costs and effort. Further investigation is called for to ascertain what types of vocational education are responsible for these large increases in earnings; unfortunately this group is too small in our sample to distinguish among the various types of vocational training.[1]

Second, it is interesting to note the implied effect education has on hours worked in the labor force, or, in other words, the effect of education on labor supply. Since the male rate of return to primary education falls when hours are held constant (compare rows 1 and 2, Table 7), primary schooling appears to increase the amount of labor supplied per man in the labor force. At higher levels of education, more schooling is associated with reduced hours worked by men per week, thus having the opposite effect on labor supply. For women, education does not appear to affect labor supplied greatly. Secondary and university training slightly reduces the hours worked by women per week, but vocational training is associated with a minor increase in hours worked.

If the private rate of return on resources to education were based on only the "real" income effect of schooling (and the median cost estimates) as discussed earlier, the return to men's primary schooling must lie between the hourly and weekly earnings estimates, 18 and 20 percent, and the return to women's vocational training would lie between 52 and 53 percent. But for the other kinds of schooling, the rate of return estimates for weekly earnings exceeds that for hourly earnings, and consequently one can only conclude that the "real" private rate of return is less than that based on weekly earnings.

Adjusting wages for domestic service occupations and underemployment reduces most noticeably the implied rate of return to women's secondary schooling, as we might expect, for domestic servants usually

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[1] Casual empiricism suggests that the foreign language secretary and the bilingual clerk make a handsome return on their short period of vocational training in the Bogota labor market.

have less than a secondary education. Holding constant the amount of other family income at 100 pesos per week we discover the returns to women's secondary and university schooling increase slightly and fall for vocational schooling.

QUALIFICATIONS

These returns to schooling are based on cross-sectional estimates of the association between private earnings and years of schooling received at an earlier date, and current costs of obtaining schooling. For an individual or society looking to the future, these cross-sectional data may not accurately reflect realistic expectations for future earnings. Probably, future earnings differentials associated with schooling will be much greater in absolute peso terms than those in 1965 that are analyzed here, though a priori it is not clear how relative differentials will change. To the extent that the effective tax rate on earnings is higher for higher earnings groups (with more education), after-tax returns would be lower than those estimated here, particularly at the higher schooling levels. The effect of taxes would, presumably, widen the already large difference in returns to secondary and university education, though these marginal increases in tax revenue due to schooling also represent a socially captured benefit.

Finally, it should be pointed out that this analysis assumes that the entire association between schooling level and earnings is due to education's productivity effect on labor. This would be valid if all other characteristics that might contribute to differences in earnings had been held constant; or in other words, that the groups compared were truly homogeneous with respect to other factors determining personal earnings. This is certainly not the case. Schooling is likely to go to those with wealth and economic and social position in society; and this elite is also likely to influence the earnings, advancement, and success of their offspring by various actions. In this connection, earnings include, inseparably, the returns to both labor and entrepreneurial physical capital. Thus, some significant portion of the

association between schooling and earnings, for at least the small class of higher educated individuals in Colombia, may be due to socio-economic position and returns on entrepreneurial capital and social connections, not education.[1] This unavoidable specification bias in our analysis probably leads to an overestimate of the "true" returns to university education, which in cross-sectional data are already very low in comparison with secondary schooling.

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[1]Martin Carnoy, in a study of the rate of return to education in Mexico, was able to hold constant the father's occupational status in an effort to correct for the socioeconomic status of the family, but found it had very little effect on the association between schooling and earnings. Mexico, however, has experienced a social revolution and rapid and sustained growth of the sort that Colombia has not seen. "Rates of Return to Schooling in Latin America," Journal of Human Resources, Vol. 2, No. 3, Summer 1967.

IV. SOCIAL RATE OF RETURN

The social rate of return on resources allocated to education is computed by compiling social costs and benefits of schooling that are not borne or captured by private individuals with those that have already been estimated on a private basis. External or social benefits are often attributed to education, but we nevertheless lack the basis for measuring these external benefits and including them in this quantitative analysis. These benefits are assumed to accrue to society but are not captured or reflected in the earnings of educated individuals. Existence of external benefits from education (in excess of social costs) implies that individuals do not have an incentive to invest the socially optimal amount in their education, and consequently public support for education is needed to achieve a socially efficient allocation of resources.

Are external effects associated with education likely to differ for various levels of education and training? A highly literate population, for example, may be a prerequisite for functioning democracy, but this line of argument for the external benefits of education, as advanced by Adam Smith and his followers, usually emphasizes basic or primary education, not advanced technical or specialized university training. One has difficulty identifying the external benefits of a highly trained and educated community of university graduates, though they may be substantial, and it is still more difficult to show that the external benefits of higher education are more significant than those for lower levels of education. It might also be more equitable to expand primary and secondary school levels than university operations. This would probably reduce the disparity in personal incomes and alleviate social turmoil and tensions.[1] In sum, neglecting the external benefits of education may depress the estimated social returns to all forms of schooling, but it is far from clear that this omission gives

[1] This conclusion depends on certain special conditions. See G. S. Becker, Human Capital and the Personal Distribution of Income, Woytinsky Lecture, University of Michigan, 1967.

rise to a relative underassessment of the returns to higher education compared to primary and secondary education.

The public or social costs of education are also difficult to appraise. Many groups, including the state, the church, and private organizations and individuals, contribute their time and resources to the Colombian educational system. No consolidated accounting of these public resource costs of education is available. An approximate idea of the public costs of education can, however, be gleaned from existing data, but as noted below they contain many weaknesses and are analyzed here largely for illustrative purposes to reinforce the main conclusions drawn from the private rate of return calculations. Budgeted operating expenditures for 1962 by the central and department governments of Colombia are subdivided into three school levels, and the cost of a student year for each level is then estimated by dividing the public expenditures by student enrollments.[1]

The educational system in Colombia is supported at three administrative levels: Central, Department, and Municipal. Operating costs were spread in 1962 among these three levels of government approximately 51, 44, and 8 percent, respectively, with municipal expenditures spent largely to support the cost of local primary education.[2] There appears to be no information on the value of the capital stock (buildings, equipment, and land) used by the educational system at various levels. Current capital expenditures are available but need not correspond closely in any single year with the value of services derived from the entire stock of capital tied up in plant and equipment. Further, other private groups, such as the church, that operate educational institutions enjoy varying degrees of governmental assistance, but there does

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[1]The public costs of education are derived from national sources, and the private benefits of education are derived from Bogota survey sources. The resulting computations of a social rate of return are a hybrid. Bogota educational expenditures would be no better, however, since 3/4 of the Bogota labor force were not born in the city, and probably the majority were schooled elsewhere.

[2]Anuario General de Estadistica 1963, DANE, Colombia 1965, pp. 792, 814, 827, 834.

not appear to be any consolidated account of the net expenditures on education contributed by these other groups.

Central and Department government budgeted expenditures for education in Colombia are summarized for 1962 in Table 8. The operating expenditures are divided among the three main school levels, omitting expenditures on general administration, scientific research, cultural extension efforts, and grants and fellowships. These public expenditures are divided by enrollment estimates for 1962, both including and excluding students at private schools. A substantial margin of error in these estimates of the average public cost of a student year of schooling is unavoidable given the fragmentary data, but some of the sources of bias that can be identified appear to be offsetting.[1] Public expenditures per student in higher education are about 40 times those spent per primary school student, and secondary school students receive about four times that spent on primary school students. Even when rough allowance is made for municipal contributions to the cost of primary schools, the ratio of public student expenditures in higher to primary education remains in excess of thirty to one.[2]

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[1] These estimates are based on enrollment figures, and the termination rate (students that drop out after the initial day of registration) is highest in the primary schools, lower in secondary schools and lowest in the universities. This differential pattern of termination implies that the actual cost of a completed year of schooling is relatively understated at the primary level compared to the secondary and university level. On the other hand, the contributions of the church and other private groups to the "public" costs of education are greater for secondary and higher education than they are for primary education, and it is reasonable to assume that capital costs, which are neglected in the above estimates, are substantially greater per student for secondary and university education than for primary schooling.

[2] According to the Anuario General de Estadistica 1963 (p. 839). In 1962 Municipal governments allocated 70,269,123 pesos to education. If this entire amount had been spent for the operations of primary schools, this would increase the estimated expenditures per primary school student in Table 8 about 20 percent. In this extreme case the public expenditures per university student would still be 34 times those spent per primary school student in 1962.

Table 8

ESTIMATED COSTS PER STUDENT AT VARIOUS EDUCATIONAL LEVELS IN COLOMBIA, 1962

	Primary Education	Secondary Education	Higher Education
Central and state government expenditures on education 1962: (thousand pesos)			
Operating costs	354,971	100,619	137,008
Investment costs	114,376	43,791	8,577
Total Costs	469,347	144,410	145,585
Number of students 1962: (thousands)			
Public	1,691	97	13
Private	303	170	20
Total	2,294	267	33
Government operating cost in 1962 per student in the:			
Public schools	209	1,037	10,539
Public and private schools	155	377	4,152

Sources:

1962 Government budget from Escobar, Alejandro Bernal, Adres Benoit, Berta Corredor and Isaac Wust, La Educacion en Colombia, Centro de Investigaciones Sociales, Departmento Socio-economico, Oficina Internacional de Investigaciones, Sociales de FRERES, Lovaina (BELGICA) y Bogota (COLOMBIA), 1965.

Student enrollment totals for primary and secondary schools derived from the low estimate series prepared by Albert Berry, Yale University. See Table 11.

Student enrollment totals for higher education derived from the Social Progress Trust Fund, fifth annual report 1965, Inter-American Development Bank, 1966, Washington, D.C., p. 236.

THE SOCIAL RETURNS TO EDUCATION

It is assumed that a fundamental objective of educational policy is to increase the productivity of social resources in general, and enhance labor's productivity in particular. Information on the social and private returns to education are both relevant to the task of the designing educational policy, for the social return signals the priorities for an efficient allocation of the society's resources, and the private return reflects the inducements to individuals to invest their resources in acquiring an education and applying their new skills to domestic employments. In the previous section some rough estimates were derived of the public costs of education per student year, but we are not able to quantify the social benefits flowing from education.[1] Adding these estimates of the public costs of education to the private costs in Table 6, the partial "social" rates of return to men for primary education decline to 15.3 percent, secondary school to 26.5 percent, university education to 2.9 percent, and vocational education to 35.4 percent. For women in the Bogota labor market the evidence implies no "social" return on primary education, 13.5 percent on secondary, 3.6 percent on university, and 39.8 percent on vocational education.[2]

INTERPRETATION

All the inadequacies discussed earlier with reference to the estimated private rates of return to education in Bogota attach to these estimates of "social" returns. The disparity in levels of returns is greater with the inclusion of public costs of education, which are heavily weighted toward students in institutions of higher education where private returns are already low. High returns associated with

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[1] Public expenditures by the Federal and State Governments in 1962 were divided by public school student enrollment plus half the private school enrollments. These estimates were then inflated by the Bogota cost of living index from 1962 to 1965. The resulting costs for primary schooling were estimated at 290 pesos per student per year, secondary schooling 1131 pesos, and higher education (university) 11,750 pesos.

[2] The social rates of return are based on adjusted hourly earnings regressions.

secondary and vocational education and substantial returns to primary education for men compare favorably with those estimated for other countries and shown in Table 9, though, of course, these estimates are in no sense exactly comparable among countries. But the low rate of return to university education in Colombia are exceptional and warrant further comment. What independent evidence is there that university training repays students meagerly in Colombia?

A low private rate of return to higher education in Colombia might lead to diminished student interest in university enrollment or increased emigration of university graduates from Colombia abroad, presumably to earn higher returns on their skills. There is no clear evidence of diminished student interest in higher education; quite the contrary, public university enrollments increased 119 percent from 1959 to 1964.[1] There are some signs, however, of increasing emigration, particularly in the early 1960s. Accurate records of emigration and immigration by educational attainment are not available to assess the net outflow of human capital from Colombia. From the high rate of exodus of Colombians applying for immigration visas to the United States in the period 1961-1963 a recent Pan American Health Organization study inferred that the professional brain drain -- particularly doctors, engineers, and technically trained university graduates -- was of more serious proportions in Colombia than in any other major Latin American country (see Appendix Table B-5).[2] It is possible, of course, that many Colombians requesting immigrant visas intend to return after several years experience in a U.S. hospital or engineering firm, but without further evidence it is probable that the return flow of professional talent will be very sensitive to demand for their services within Colombia.

The low rate of return to university education in Colombia may be a cyclical phenomenon stemming from the low level of domestic effective

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[1] Inter-American Development Bank, Social Progress Trust Fund, Fifth Annual Report 1965, Washington, D.C., 1966, p. 236.

[2] Migration of Health Personnel, Scientists and Engineers from Latin America, Pan American Health Organization, World Health Organization, Washington, D.C., 1966.

Table 9

INTERNATIONAL COMPARISONS OF RATES OF RETURN TO EDUCATION

Approximate Educational Levels	Colombia[a] 1965 Private Rate	Colombia[a] 1965 Social Rate	Mexico[b] 1963 Private Rate	Chile[c] 1959 Social Rate	Venezuela[d] 1957 Social Rate (urban)	Puerto Rico[e] 1959 Private Rate (urban)	Philippines[f] 1966 Private Rate	India[g] 1960-1961	U.S.A.[h] 1959 Private Rate (North-white)
Primary over none	18	15	45	24	82	28	9	17	22
Middle over primary	--[i]	--[i]	17	29	--[i]	--[i]	--[i]	14	16
Matriculation over middle	34	27	15	17	17	14	29	12	16
University over matriculation	5	3	40	12	23	15	12	10	10

Notes:

[a] Bogota men, the private return from Table 7 of this study adjusted for hours worked, the social return cited on preceding page.

[b] Men: Martin Cornoy, "Rates of Return to Schooling in Latin America," Journal of Human Resources, Vol. II, No. 3, Summer 1967, Table 7, p. 368.

[c] Men and women: Arnold Harberger and Marcelo Selowsky, "Key Factors in Economic Growth in Chile," paper presented at Cornell University Conference, "Next Decade in Latin American Development," April 1966 (mimeo).

[d] Urban males presumably: Carl Shoup, The Fiscal System of Venezuela, Johns Hopkins Press, Baltimore, 1959.

[e] Men: H. R. Carby-Samuels, "Income and Returns to Education in Puerto Rico," University of Chicago, August 30, 1965 (mimeo), Table XII, p. 22.

[f] Men: Jeffrey G. Williamson and Don J. DeVoretz, "Education as an Asset in the Philippine Economy," Institute of Economic Development and Research, School of Economics, University of the Philippines, Discussion paper 67-15, November 6, 1967, Table 5.3.1, p. 39.

[g] Men: A. M. Nalla Gounden, "Investment in Education in India," Journal of Human Resources, Vol. II, No. 3, Summer 1967, Table 2, p. 352.

[h] Men: Giora Hanoch, "An Economic Analysis of Earnings and Schooling," Journal of Human Resources, Vol. II, No. 3, Summer 1967, Table 3, p. 352.

[i] In these countries the secondary educational system spans from primary to university. Thus, the rate of return calculations pertain to a matriculation over primary education.

demand during the prolonged recession experienced by Colombia since 1961. Labor turnover and training costs appear to induce employers in the United States to concentrate cyclical hiring and firing among the least educated and skilled workers. As a rule, therefore, wage and unemployment differentials associated with skill and education narrow in periods of excess demand and widen in periods of deficient demand in the United States and other developed countries. But this pattern does not appear to hold in Colombia, where low skilled labor is shielded by paternalistic labor laws from the vicissitudes of business fluctuations. If wage earners are protected from cyclical fluctuations in effective demand, profits and professional hirings may be more sensitive to economic conditions. Slighton has found some evidence of this pattern of cyclical change in the personal distribution of income in Bogota, where from 1963 to 1966 the relative income status of upper occupational classes and the relative income share of the top decile of income units were most severely undermined by the foreign exchange crisis and economic slowdown that marked these years.[1] But our fragmentary data do not permit separation of secular and cyclical changes, and it seems doubtful that the recent recession in Colombia would greatly affect the relative earnings position of university graduates except among the youngest, least experienced generation.

A second factor that may be of some importance is the compositional mix of university graduates in Colombia. Two-thirds of the graduates that took their degrees before 1956 and were still working in 1964 had studied law or medicine.[2] The excess supply of lawyers in the Colombian labor market often draws comment in labor studies; most lawyers take jobs where their training has no particular relevance and accept salaries some 15 percent below those paid to engineers, scientists, and economists.[3]

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[1] R. L. Slighton, Relative Wages, Skill Shortages, and Changes in Income Distribution in Urban Colombia, The RAND Corporation, RM-5651-AID (forthcoming).

[2] See Appendix Table B-3.

[3] The Law, one should recall, is the traditional prerequisite to political participation, which may purchase forms of power and prestige that are not reflected (legally) in earnings.

A third factor is emphasized in a recent study of the Colombian labor market for high-level manpower: lack of perception of the need for high-level manpower among the managerial elite in Colombia, which leads to insufficient demand to absorb the current supply of professional talent. This study concludes that though the economy evidently "needs" additional high-level manpower, if additional human resources are supplied they will not be currently utilized.[1] Without probing the authors' judgment as to the economy's "needs," their evidence from 1967 confirms that there continues to be no severe shortage of high-level manpower today in Colombia.

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[1]W. Bowman Cutter, Howard J. Howe, and Charles C. Stover, "High-Level Manpower in Colombia: A Market Analysis," August 1967, Princeton University, pp. 94-96 (mimeo).

V. POLICY PRIORITIES

NATIONAL EDUCATIONAL POLICY

In planning educational policy a country contends with two issues: what is the best social allocation of resources with regard to education, and how can people be motivated to acquire and to use their education in employments where social returns are highest. The first issue deals with the efficiency of resource use, although the policy objective may be construed to encompass not only economic but political and social aims as well. The economic aim, however, is assumed here to be central: social resources are to be allocated among levels of education and between education and other activities to enhance their economic productivity. The second issue for national educational policy deals with the structure of private incentives and information which in a free society underlie and reinforce the private allocation of human and physical resources. Though educational policy has usually been implemented by means of subsidies paid directly to the educational system, this single policy instrument may not be effective in achieving both the social and private counterparts of the national educational objective. In particular, with the increasing international mobility of labor, such countries as Colombia may need to develop a more refined set of policy instruments to deal with national educational policy. The concluding section of this Memorandum attempts to put our empirical findings on the private and social rate of return to education in the context of educational policy formation in Colombia.

RECENT PERFORMANCE

Laboring under the rapid increase in population, Colombia has succeeded in extending educational opportunities to an increasing share of each succeeding generation. This has been no mean task. The most rapid growth in population in the 1950s came in the primary school age group, as shown in Table 10, where the annual average rate of growth more than doubled from 1.8 to 4.3 percent, between the last two intercensus periods. This surge in growth of school aged population stemming from the postwar reduction in child death rates began to influence

Table 10

ANNUAL AVERAGE RATES OF GROWTH IN SCHOOL-AGE POPULATION IN COLOMBIA, 1938-1974

School Age Populations	1951/1938	1964/1951	1974[a]/1964
Primary school age 7 to 14[b]	1.8	4.3	2.5-3.5[a]
Secondary school age 15 to 19	2.0	3.4	4.4
University age 20 to 24	2.2	2.1	4.3
All school age 7 to 24	1.9	3.6	3.4-3.9[a]

Notes:

[a]1974 projection of population under assumption that the survival probabilities are those given in West Life Table 14 (Ansley J. Coale and Paul Demeny, Regional Model Life Tables and Stable Populations, Princeton University Press, Princeton, 1966). In the lowest age group that had not been born in 1964, beginning to enter primary school by 1974, two assumptions were made about the level of birth rates in 1965-1968. The lower rate of growth of the primary school population appears the more probable.

[b]It is assumed here that 3/5 of the age cohort 5-9 is seven years or older or of primary school age.

Source:

Basic age distribution data from the 1938, 1951, and 1964 censuses and the procedure used to project the 1964 census population to 1974 are set forth in greater detail in T. P. Schultz, Internal Migration: A Quantitative Analysis, The RAND Corporation, P-3905, August 1968.

the rate of growth of secondary school aged population before the 1964 census, but will further accelerate the rates of growth of the secondary and university aged groups to more than 4 percent per year in the early 1970s.

Official figures on student enrollment in Colombia vacillate unreasonably from year to year due to the changing coverage of the series, but smoothed estimates prepared by Professor A. Berry shown in Table 10 suggest enrollment expansion has exceeded the pace of population growth at least since World War II. From 1950 to 1962 annual growth in primary school enrollment averaged 8.5 percent, and that for all forms of secondary, vocational, and commercial schools averaged 10.7 percent per year.[1] Universities and other institutions of higher education have grown still more rapidly; first year enrollments increased 11.5 percent per year from 1959 to 1964.[2] See Table 11. The composition of specialties among university graduates has also shifted markedly in the last decade from traditional fields of study such as law, medicine, humanities and fine arts to agriculture and natural

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[1]Enrollment figures are collected for the initial day of school and may drop precipitously thereafter, making it difficult to determine what proportion of the enrolled students benefit from a full year of instruction. Since the census enumeration of students may be exaggerated or somehow biased, independent estimates of school enrollment were derived from national series prepared by Professor Albert Berry which underlie Table 11. It is assumed for simplicity that all students enrolled in primary school are between the ages of 7 and 14, and secondary and vocational school students are between the ages of 15 and 19. It is then possible to estimate that primary school enrollment increased from 1950 to 1962 from 39 to 51 percent of the approximate age group, and secondary and vocational enrollment increased from 9 to 16 percent. Because the school groups are not exactly coincident with the census age groups, in all probability primary school enrollment is somewhat overstated by these figures, and secondary and vocational school enrollment somewhat understated. Extending these estimates to 1951 and 1964, they appear to be consistent with the census figures summarized in Table 12.

[2]Inter American Development Bank, Social Progress Trust Fund Fifth Annual Report 1965, Washington, D.C., 1966, p. 236.

Table 11

GROWTH OF COLOMBIAN SCHOOL SYSTEM, 1935-1962

Year	Primary			Secondary			Normal (teachers)		Commercial		Total Secondary, Normal and Commercial
	Number of Students (in thousands)	Index of Number of Students	Student/ Teacher Ratio	Average School Size	Index of Number of Students	Student/ Teacher Ratio	Average School Size	Index of Number of Students	Student/ Teacher Ratio	Index of Number of Students	Student/ Teacher Ratio	Index of Number of Students
1935	583	100	45	61	100	10:1	62	100	6:8	100	15:5	100
1945	737	128	40	61	152	10:8	70	181	7:8	163	10:3	156
1950	893	153	37	62	220	11:2	102	244	7:2	224	11:8	222
1955	1287	221	38	73	271	11:0	112	429	7:7	265	10:5	280
1960	1740	298	38	83	456	11:0	148	984	10:0	497	12:0	531
1962	1994	342	36	86	558	12:4	160	1464	10:8	523	11:1	610

Source:

Estimates of Albert Berry of Yale University of Student, Teacher and School totals for Colombia. Wide range of possible error in his data sources and methodology encouraged him to offer a variety of estimates, which would hopefully enclose the true series. The data are derived from his estimated series that probably exaggerates somewhat the growth by understatement before World War II and overstatement thereafter. Since annual reported data (in the Anuario General de Estadistica, DANE, Colombia) vacillate to an unreasonable extent, these estimates are probably the best available series on the size and character of the Colombian educational system. Underlying estimates supplied in personal correspondence with Berry.

sciences, social sciences and engineering (see Appendix Table B-3).[1] See Table 12.

Colombia has thus managed to increase the proportion of each rapidly growing age group brought into the school system, both in urban and rural regions. According to the censuses, the fraction of primary school aged children (7-14) in school in Colombia increased from 35 to 52 percent from 1951 to 1964. Among secondary school aged children (15-19) the share increased from 12 to 23 percent, and among those of university age (20-24) the fraction in school rose from less than 2 to more than 4 percent. There is some cause for concern, however, for among the departments of Colombia the record of educational advance shows substantial variation (see Appendix Tables B-1 and B-2).

POLICY IMPLICATIONS

Estimates of the rate of return to resources allocated to different kinds and levels of schooling provide some rough indication for policy priorities. But the basis of this study is much too limited to support detailed suggestions or normative judgments as to the direction of Colombian educational policy. Other groups examining various components of the Colombian educational system are in a better position to make

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[1] Despite a radical change in composition Appendix Table B-3 still shows one-fourth of university graduates in 1959-1963 were in law, and one-fifth in medicine in contrast with 17 percent in engineering, 11 percent in the social sciences, 9 percent in the natural sciences, and less than 6 percent in the agricultural sciences. The relative composition of college graduates in Colombia and the United States reflects differences in orientation of higher education. 14 percent of U.S. college graduates major in the natural and physical sciences compared with 8 percent in Colombia. In law and medicine the shares are 2.4 and 6.2 percent in the United States, whereas in Colombia they are 18 and 20 percent. Education also claims a much larger share of college graduates in the United States, about 23 percent compared with 8 percent in Colombia. This greater relative importance of college graduates in education may be a direct result of the much higher proportion of the total population enrolled in institutions of higher education in the United States than in Colombia (about 20 to 1). United States data from the Statistical Abstract of the United States, 1963, Table 184, and Colombian data from those presented in Table 11.

Table 12

STUDENTS PER HUNDRED POPULATION BY AGE, SEX, AND REGION:
COLOMBIA, 1951 AND 1964

Age in Years	Total Population				Cabeceras or Urban Population				Other Regions or Rural Population			
	Male		Female		Male		Female		Male		Female	
	1951	1964	1951	1964	1951	1964	1951	1964	1951	1964	1951	1964
5-9	17.3	25.6	17.6	26.3	27.5	36.9	27.6	36.9	12.0	15.1	12.0	15.7
10-14	39.7	58.2	38.0	56.1	59.6	76.2	55.6	70.7	28.8	40.7	26.1	39.1
15-19	13.7	26.6	9.5	22.0	26.6	43.2	16.1	31.5	6.2	9.5	3.9	7.5
20-24	2.8	5.9	.9	2.3	6.2	10.6	1.6	3.6	.6	1.0	.2	.5
25-29	.6	1.0	.3	.4	1.3	1.8	.5	.6	.1	.2	.1	.1

Sources:
Censo de Poblacion de Colombia 1951 Resumen, Table 11, p. 37, and Table 39, p. 188. XIII Censo Nacional de Poblacion (Julio 15 de 1964) Resumen General, Table 7, pp. 33+, and Table 41, pp. 143+.

such policy recommendations.[1] The survey data from Bogota that are analyzed here imply that the private and social return to expansion of primary, secondary, and vocational education are substantial, and given the relatively modest share of national income currently allocated to the support of education in Colombia, there may be reason to increase the public budget for education, and perhaps redistribute the resources somewhat among regions and levels (see Appendix Table B-4).

The estimated returns to resources rely on the association between schooling and personal earnings in Bogota in 1965. In addition to these effects of schooling on the productive capacity of individuals in Bogota, other fundamental problems faced by Colombia may be alleviated by expansion of public investment in basic education, and yield important though difficult to quantify benefits for Colombia as a whole.[2]

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[1]Several studies are underway or recently completed dealing with the Colombian educational system. The University of California Advisory Mission working with the Asociacion Colombiana de Universidades-Fondo Universitario Nacional and AID has submitted a number of reports and recommendations which are summarized by George C. Feliz, "Recommendations for the Development of Higher Education in Colombia," Colombian Higher Education Project, Bogota, Colombia, 1967. The International Bank has been considering an expansion of secondary-vocational education, and AID has supported a number of other investigations. Work done at RAND by M. B. Carpenter, L. G. Chesler, H. S. Dordick, and S. A. Haggart on the potential role of modern technology in education considered the specific constraints posed by the Colombian environment.

[2]Expanding rapidly, a school system incurs the problem of finding the needed supply of new teachers. To meet this problem, scarce resources and talent must be diverted from the immediate task of teaching children to the round-about job of increasing the future supply of teachers. The inelastic supply of teachers is frequently the binding constraint to the rate of expansion of the educational system, and one that can be relaxed readily only with time or by sacrificing quality. In Colombia, however, it is plausible at least that higher salaries for qualified teachers would attract a substantial number of accredited teachers back into the school system who have in the past taken employment in other occupations. In the next decade as the secondary and vocational school systems come under increasing pressure to expand their enrollments, choices may become harder on where to allocate public funds among the various levels of the school system, and whether quality should be sacrificed to school a greater proportion of the next generation.

Two social or external effects of education deserve mention in this context. Increasing the proportion of children in school is found to be closely associated in Colombia with a lower birth rate in that region. The causal mechanism proposed to explain this association, which has been documented in other developing countries, is that schooling raises the costs of rearing large families and induces parents to seek fewer children. School not only imposes direct costs on parents but in part it also denies parents the productive services of their offspring as unpaid family workers. As was noted earlier, the increased opportunities for education at the primary and secondary school levels have been unevenly distributed across Colombia (see Appendix Tables B-1 and B-2). One important side effect of expanding basic educational opportunities in the less prosperous and more rural regions of Colombia might be to slow the unprecedented 3 percent per year national rate of population growth which appears to currently inhibit the advance and the more equal distribution of personal welfare in Colombia.

Another elusive effect of primary and secondary schooling is to improve the efficiency of the national labor market. The internal migration of labor, mainly from the rural to the urban sector, is linked to the schooling of the younger generation of potantial migrants. Available evidence indicates that the urban immigrant is substantially more productive in the urban sector of the economy, even if his contribution is low by urban standards, than he was in the rural sector of the economy in which he worked prior to coming to the city.[1] The redistribution of labor from less to more productive employments is hastened by expanded educational opportunities in the small towns and countryside, and such structural shifts in the distribution of labor are an important source of increasing national per capita output that is missed in an analysis such as this based on education-earnings data from one location at one point in time.

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[1] See Appendix Table B-6 for evidence from the Health Manpower Survey of household income by educational attainment and rural/urban residence in Colombia in 1965-1966.

Higher education raises more complex policy problems about which we know relatively little. A few insights have emerged from this study that may add to the dialogue on future policy.[1] A rapid shift of the supply of university graduates in Colombia has undoubtedly contributed both to depressing the returns to higher education and to initiating emigration among this group to the United States, Venezuela, and elsewhere. Continued expansion of public support for higher education without rapid growth in domestic demand for high-level talent may only accelerate emigration.

It is difficult to know whether in the longer run the social returns to public support of university growth are likely to be as attractive as those to support of expansion and improvement of the secondary and vocational school systems. Until the private rate of return to higher education is manifestly greater than it is today, public policy may be more effective if it seeks directly to subsidize persons engaged in activities where external benefits are presumed to be important, rather than continue to underwrite the costs of university training for all students, some of whom are likely to emigrate upon graduation for more remunerative jobs abroad.[2]

Increasing international mobility of university trained manpower poses a complex problem for countries, like Colombia, that seek to develop a broad, publicly supported university system and yet do not now demand and hold the services of a sufficient number of their own college graduates. If it is believed that the social externalities of training and maintaining a large pool of university schooled manpower are important objectives of the society that will, over the years, yield high returns, then new policies are required to attract

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[1] It is probable, for example, that income taxes bear most heavily on university trained persons in many societies, for they are compelled to receive most of their income in the form of readily taxed salary payments, whereas entrepreneurs and landowners probably escape the full force of the income tax system by accounting techniques and capital gains arrangements.

[2] George C. Feliz, "Recommendations for the Development of Higher Education in Colombia," Colombian Higher Education Project, Bogota, Colombia, 1967.

these human resources and raise their returns within the domestic labor market. Special research institutions as well as new tax and transfer policies may be required in addition to public support of university budgets if this objective is not to be frustrated via emigration.

Appendix A

SUPPLEMENTARY STATISTICAL MATERIALS: CHAPTER III

Table A-1

ESTIMATED UNADJUSTED MALE WAGES
BY AGE AND SCHOOLING: BOGOTA, SEPTEMBER 1965
(in pesos per hour)

Synthetic Graduate by Education Type (and Years of Schooling)	Age Cohort						
	Less Than 20	20-24	25-34	35-44	45-54	55-64	65 or more
None (0)	.21	.64	1.32	1.78	1.44	.91	.92
Primary (5)	.36	1.10	2.26	3.05	2.47	1.55	1.58
Secondary (11)	1.23	3.78	7.77	10.49	8.48	5.33	5.42
University (16)	2.37	7.26	14.91	20.13	16.27	10.23	10.39
Vocational (8)	.50	1.54	3.16	4.26	3.45	2.17	2.20

Source:
Table 2 - regression 2.

Table A-2

ESTIMATED UNADJUSTED FEMALE WAGES
BY AGE AND SCHOOLING: BOGOTA, SEPTEMBER 1965
(in pesos per hour)

Synthetic Graduate by Education Type (and Years of Schooling)	Age Cohort						
	Less than 20	20-24	25-34	35-44	45-54	55-64	65 or more
None (0) / Primary (5)	.23	.52	.86	1.00	1.39	.63	.95
Secondary (11)	.80	1.79	2.93	3.40	4.75	2.16	3.25
University (16)	3.15	7.08	11.60	13.47	18.82	8.54	12.88
Vocational (8)	.55	1.23	2.01	2.34	3.27	1.48	2.24

Source:
Table 3 - regression 8.

Table A-3

ESTIMATED ADJUSTED FEMALE WAGES
BY AGE AND SCHOOLING, HOLDING FAMILY INCOME
CONSTANT: BOGOTA, SEPTEMBER 1965
(in pesos per hour)

Synthetic Graduate by Education Type (and Years of Schooling)	Age Cohort						
	Less than 20	20-24	25-34	35-44	45-54	55-64	65 or more
None (0) / Primary (5)	.31	.60	.93	.96	.89	.67	.82
Secondary (11)	.93	1.80	2.80	2.90	2.68	2.03	2.46
University (16)	4.65	9.07	14.06	14.56	13.47	10.21	12.37
Vocational (8)	.69	1.35	2.10	2.17	2.01	1.52	1.85

Note:

[a]Family income is held constant at 100 pesos per week. Family income defined as income of other persons in the respondent's household except when the respondent is a live-in domestic servant, in which case the respondent is attributed zero family income.

Source:

Table 3 - regression 10.

Table A-4

ESTIMATED COSTS OF SCHOOLING IN COLOMBIA
FROM OCTOBER 1961 to FEBRUARY 1962[a]
(in pesos)

Years of Schooling	Assumed Age	Direct Costs Male	Direct Costs Female	Opportunity Costs Male	Opportunity Costs Female	Total Costs Male	Total Costs Female
Primary							
1	9	376	295	-	-	376	295
2	10	340	380	-	-	340	380
3	11	493	407	-	-	493	407
4	12	548	519	-	-	548	519
5	13	545	573	-	-	545	573
Secondary (Academic Course)							
1	14	654	728	-	-	654	728
2	15	834	805	1730	1680	2564	3485
3	16	694	757	860	2100	1554	2857
4	17	366	995	2100	2918	2466	3913
5	18	815	1237	2800[b]	2550[b]	3615	3787
6	19	991	1004	1400[b]	2100[b]	2391	3104
University							
1	20	933	1033	2100[b]	3918[b]	3033	4951
2	21	1000	1150	8400	6300	9400	7450
3	22	1208	800	8400	5460	9608	6260
4	23	1250	1610	6996	8400	8246	10010
5	24	1146[c]	550	10500	9096	11646	9646
Secondary (Technical Course)[d]							
1	14	437	714	-	-	437	714
2	15	390	694	1730	1680	2120	2374
3	16	775	715	860	2100	1635	2810
4	17	538	432	2100	2918	2638	3350
5	18	445	e	2800[b]	2550[b]	3245	e
6	19	e	608	1400[b]	2100[b]	e	2708

Notes:

- assumed to be zero opportunity costs till age 15.

[a]These estimates are derived from Guillermo Franco Camacho, Rendimiento de la Inversion en Educacion en Colombia, Centro de Estudios sobre Desarrollo Economico, Bogota, Colombia, July 1964. The following changes are made from Franco's estimates. The University course is assumed here to take 5 rather than 6 years and vocational course 3 rather than 4 years. In that the earnings estimates are with respect to years of either form of higher education, the different length of course is embodied in both the cost and benefit side of our calculations.

Table A-4 continued

[b]Franco assumes the opportunity income forgone in these years is only one-half the annual sum. The method or reasoning behind this approach is not stated in his paper.

[c]Average of 5th and 6th year in university is shown here since 5th year is exceptionally low for a very small sample class. No 6th year sample of females was included so similar average was not possible for women.

[d]Opportunity costs for technical course secondary schools (media) are the same as for the academic course secondary, though this assumption does not appear particularly plausible.

[e]No persons in the Franco sample in these age-education classes.

Table A-5

COMPARISON OF INCOME ESTIMATES BY FRANCO
(A-1961/1962) AND BOGOTA EARNINGS ESTIMATES (B-1965)
BY SEX, AGE AND EDUCATION[a]
(in current pesos per year)

	None		Primary		Secondary		University[b]	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
Age Males								
12-17	2520	504	2100	864	--	--	--	--
17-20			4200		10452	1920		
20-24		1536	6300[c]	2640		5856	27996[c]	11016
25-34	3013[c]	3192	8600[d]	5496	23304[c]	12144		22824
35-44	2905[c]	4200	12000[c]	7248	33792[c]	16032	42000[c]	30144
45-54	3120[c]	3432	14004[c]	5904		13056		24552
55-64	3806[c]	2182	12000[c]	3744	24900[c]	8280	25992[c]	15552
65 or more		2208	9960	3792		8376		15768
Age Females								
14-20	2518[c]	1152	4200[c]	1152	--	--	--	--
20-24		1776		1776	7836[c]	4200	10956[c]	16944
25-34	4090[c]	2832	7200[c]	2832	9600[c]	6720	15444[c]	27072
35-44	1125[c]	2904		2904		6888		27768
45-54	1550[c]	3024	3600[c]	3024	5400[c]	7200	20004[c]	29016
55-64		2568		2568		6096	e	24624
65-or more	e	2952	1800[c]	2952		7008	e	28272

Notes:

-- indicates not applicable.

[a]Bogota estimated adjusted hourly wage multiplied by 2400 (48-hour week, 50 weeks) to estimate annual earnings. The consumer price index in Bogota increased from October 1961-February 1962 to September 1965 some 63 percent.

[b]University earnings are estimated for B by assuming degree is obtained after 5 years, although 6 is postulated in Franco's study (A).

[c]Age groups do not exactly correspond to those reported.

[d]Two age groups averaged to correspond approximately with those reported.

[e]No persons in the Franco sample in these classes.

Sources:

(A) Franco, Tables 1 and 2; (B) derived from Tables 5 and 6 above.

Table A-6

AVERAGE WEEKLY EARNINGS OF MEN IN LABOR FORCE: BOGOTA, SEPTEMBER 1965[a]
(in pesos)

Schooling (in years)	Less than 15	15-19	20-24	25-34	35-44	45-54	55-64	65 or over
0-1	--	--	57.0 (5)	141.8 (14)	103.5 (10)	146.2 (13)	82.0 (5)	25 (2)
2-4	20.8 (6)	48.5 (33)	103.0 (27)	171.8 (55)	260.1 (49)	158.9 (27)	84.0 (5)	88.3 (3)
5	50.0 (1)	57.0 (32)	143.3 (21)	225.2 (47)	182.2 (38)	259.7 (34)	186.0 (15)	233.3 (3)
6-10	10.0 (3)	119.1 (17)	216.5 (27)	324.7 (34)	347.0 (43)	424 (15)	295.8 (12)	175.0 (1)
11	--	50.0 (1)	243.8 (8)	603.7 (22)	1029.7 (16)	377.5 (10)	1400.0 (3)	2025.0 (2)
12-15	--	50.0 (1)	215.0 (6)	507.5 (10)	915.0 (10)	983.3 (3)	450.0 (2)	--
16 or more	--	--	--	948.1 (13)	1700.0 (6)	1291.7 (6)	958.3 (6)	--

Notes:

-- indicates not applicable.

[a]The number of respondents in each age-education class is shown in parentheses below the class's average earnings.

Source:

CEDE Survey data edited and tabulated by William Allen at RAND.

Table A-7

AVERAGE WEEKLY EARNINGS OF WOMEN IN LABOR FORCE: BOGOTA, SEPTEMBER 1965[a]
(in pesos)

Schooling (in years)	Less than 15	15-19	20-24	25-34	35-44	45-54	55-64	65 or over
0-1	21.7 (9)	30.7 (14)	27.3 (11)	44.6 (13)	48.1 (13)	36.0 (5)	32.5 (5)	30.0 (1)
2-4	11.3 (8)	35.1 (39)	52.5 (22)	85.6 (24)	97.5 (10)	55.0 (8)	38.3 (3)	77.5 (2)
5	30.0 (1)	35.4 (14)	55.0 (14)	92.3 (24)	116.8 (14)	99.0 (5)	70.0 (1)	77.5 (2)
6-10	--	80.6 (9)	149.3 (27)	175.8 (20)	189.0 (10)	262.5 (2)	--	--
11	--	0.0 (1)	261.4 (11)	296.3 (8)	175.0 (2)	--	275.0 (1)	--
12-15	--	0.0 (1)	221.4 (7)	250.0 (5)	--	575.0 (2)	275.0 (1)	--
16 or more	--	--	912.5 (4)	862.5 (2)	800.0 (1)	--	800.0 (1)	--

Notes:

-- indicates not applicable.

[a]The number of respondents in each age-education class is shown in parentheses below the class's average earnings.

Source:

CEDE Survey data edited and tabulated by William Allen at RAND.

Appendix B

COLOMBIAN EDUCATIONAL SYSTEM

Table B-1

PERCENT OF AGE GROUPS IN SCHOOL, BY DEPARTMENTS IN 1951 AND 1964[a]

Department	Age 10-14		Age 15-19		Age 20-24	
	1951	1964	1951	1964	1951	1964
Antioquia	47.1	n.a.	10.7	n.a.	2.1	n.a.
Atlantico	56.6	72.8	22.6	40.7	1.4	6.1
Bolivar	29.1	48.4[b]	14.4	34.3[b]	2.1	20.0[b]
Boyaca	32.9	55.2	7.7	18.8	.9	3.3
Caldas	42.5	62.9	10.2	23.1	1.3	3.8
Cauca	32.2	28.9	7.6	4.7	1.5	.2
Cordoba	n.a.	40.3	n.a.	20.1	n.a.	2.0
Cundinamarca	46.5	55.3	15.9	20.0	4.8	2.8
Huila	31.8	56.0	9.1	17.8	.7	2.1
Magdalena	46.5	47.5	16.2	24.4	1.4	3.4
Meta	n.a.	57.6	n.a.	15.1	n.a.	1.1
Narino	30.7	37.7	7.5	14.2	.8	2.1
N. De Santander	34.7	51.9	10.4	22.2	1.0	3.4
Santander	31.7	56.2	8.3	20.8	.8	3.1
Tolima	30.3	53.3	8.2	20.2	.9	2.8
Valle	42.5	64.4	10.5	24.6	1.2	3.4

Notes:

n.a. - Data not available.

[a]Average of percent male and female in school from Table A-8.

[b]Female student totals from census for Bolivar appear to be unreasonably large. They may represent a typographical error in the underlying data.

Source:

Table B-2.

Table B-2

PERCENT OF AGE AND SEX GROUPS ECONOMICALLY ACTIVE AND IN SCHOOL
BY DEPARTMENTS FOR THE CENSUSES OF 1951 AND 1964

	1951						1964					
	Economically Active		Students		Economically Active & Students		Economically Active		Students		Economically Active & Students	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Antioquia												
Age 10-14	17.4	3.0	47.9	46.2	65.3	49.2						
15-19	85.6	21.3	12.2	9.1	97.8	30.4			(Not available)			
20-24	95.2	20.0	3.0	1.1	98.2	21.1						
Atlantico												
Age 10-14	7.2	5.1	56.5	56.7	63.7	61.8	4.6	3.6	72.7	72.8	77.3	76.4
15-19	70.9	22.2	26.7	18.4	97.6	40.6	40.1	22.9	47.3	34.1	87.4	57.0
20-24	98.0	24.3	1.6	1.1	99.6	25.4	82.8	30.1	9.7	2.4	92.5	32.5
Bolivar												
Age 10-14	12.6	4.2	27.3	30.9	39.9	35.1	17.7	3.5	47.6	49.2[a]	65.3	52.7[a]
15-19	81.9	13.6	17.5	11.3	99.4	24.9	58.3	15.9	31.6	37.0[a]	89.9	52.9[a]
20-24	95.7	14.7	3.5	0.6	99.2	15.3	88.4	19.8	6.6	31.3[a]	95.0	51.1[a]
Boyaca												
Age 10-14	17.9	8.4	37.1	28.7	55.0	37.1	19.4	4.8	58.1	52.2	77.5	57.0
15-19	88.5	23.8	9.9	5.5	98.4	29.3	75.4	18.5	19.8	17.7	95.2	36.2
20-24	96.8	21.6	1.4	0.3	98.2	21.9	92.4	20.3	4.4	2.1	96.8	22.4
Caldas												
Age 10-14	18.2	3.1	44.4	40.6	62.6	43.7	15.7	2.5	64.7	61.0	80.4	63.5
15-19	86.3	13.8	12.6	7.7	98.9	21.5	68.5	14.8	28.0	20.1	94.5	34.9
20-24	96.4	14.8	1.9	0.7	98.3	15.5	90.2	18.9	5.5	2.1	95.7	21.0
Cauca												
Age 10-14	17.7	6.5	33.5	30.9	51.2	37.4	37.3	27.9	30.6	27.2	67.9	55.1
15-19	89.0	24.7	9.1	6.1	98.1	30.8	89.7	41.3	5.6	3.8	95.3	45.1
20-24	94.6	23.7	2.5	0.4	97.1	24.1	97.7	37.1	0.3	0.1	98.0	37.2
Cordoba												
Age 10-14			(Included in Bolivar)				18.2	4.1	39.5	41.0	57.7	45.1
15-19							70.4	15.0	23.3	16.8	93.7	31.8
20-24							94.9	17.4	3.0	0.9	97.9	18.3
Cundinamarca												
Age 10-14	18.8	10.6	48.0	45.0	66.8	55.6	19.1	4.6	56.3	54.3	75.4	58.9
15-19	80.0	36.8	17.8	14.0	97.8	50.8	76.0	19.6	18.3	21.7	94.3	41.3
20-24	91.0	37.1	7.4	2.1	98.4	39.2	93.8	22.3	3.5	2.1	97.3	24.4
Huila												
Age 10-14	19.3	8.6	31.6	31.9	50.9	40.5	18.5	5.0	55.8	56.1	74.3	61.1
15-19	86.0	25.9	11.4	6.7	97.4	32.6	76.7	21.8	19.1	16.4	95.8	38.2
20-24	96.4	23.1	0.9	0.4	97.3	23.5	94.4	21.6	2.8	1.3	97.2	22.9
Magdalena												
Age 10-14	11.5	3.6	53.9	38.9	65.4	42.5	15.2	2.5	46.6	48.4	61.8	50.9
15-19	79.9	22.0	19.6	12.8	99.5	34.8	61.4	13.0	26.9	21.9	88.3	34.9
20-24	96.9	14.3	2.1	0.6	99.0	14.9	90.0	18.2	5.1	1.7	95.1	19.9
Meta												
Age 10-14							19.1	4.9	56.8	58.3	75.9	63.2
15-19			(Not available)				81.7	25.3	14.7	15.4	96.4	40.7
20-24							94.8	25.4	1.3	0.8	96.1	26.2
Narino												
Age 10-14	14.8	10.0	33.5	27.8	48.3	37.8	24.4	7.4	40.0	35.3	64.4	42.7
15-19	87.1	41.6	9.4	5.5	96.5	47.1	78.7	30.9	15.7	12.7	94.4	43.6
20-24	95.7	39.8	1.3	0.3	97.0	40.1	92.8	32.4	3.0	1.2	95.8	33.6
N. De Santander												
Age 10-14	16.7	5.8	35.6	33.7	52.3	39.5	17.8	4.0	52.7	51.2	70.5	55.2
15-19	87.3	21.8	11.6	9.1	99.1	20.9	68.5	19.2	23.6	20.9	92.1	40.1
20-24	96.8	20.5	1.5	.4	98.3	20.9	90.9	23.4	4.7	2.0	95.6	25.4
Santander												
Age 10-14	20.7	8.4	32.3	31.0	53.0	39.4	20.0	6.0	57.0	55.4	77.0	61.4
15-19	88.9	29.3	9.3	7.3	98.2	36.6	73.3	27.0	22.0	19.6	95.3	46.6
20-24	96.3	26.7	1.3	0.3	97.6	27.0	92.1	28.6	4.3	1.8	96.4	30.4
Tolima												
Age 10-14	25.5	6.6	30.6	29.9	56.1	36.5	21.9	4.2	53.2	53.3	75.1	57.5
15-19	75.3	21.5	9.9	6.5	85.2	28.0	74.9	19.0	20.9	19.6	95.8	38.6
20-24	97.3	20.3	1.3	0.5	98.6	20.8	92.8	20.2	4.1	1.5	96.9	21.7
Valle												
Age 10-14	17.3	5.1	43.3	41.7	60.6	46.8	11.8	4.0	66.5	62.3	78.3	66.3
15-19	85.8	23.8	13.1	7.8	98.9	31.6	64.7	24.6	28.6	20.5	93.3	45.1
20-24	96.3	22.9	1.9	0.5	98.2	23.4	90.5	27.6	5.1	1.7	95.6	29.3

Note:

[a]Number of female students unreasonably large. The error in the underlying data may be typographical.

Source:

1951 data from published Department volumes of 1951 Colombian Census. Data for 1964 from unpublished Census tabulations. The data for Antioquia in 1964 should become available, while that for Meta and Cordoba in 1951 cannot be derived as these Departments were not distinguished in the earlier Census.

Table B-3

DISTRIBUTION OF UNIVERSITY GRADUATES BY SPECIALTY IN COLOMBIA, 1964

Specialty	University Degrees 1964	Percent of Degrees[a] By Date of Graduation 1920-1955	1956-1959	1960-1963
Engineering	6,819	13.9	14.0	17.1
Agriculture	2,077	4.7	3.2	5.2
Medicine	13,328	34.8	32.0	19.7
Natural and Physical Sciences	3,077	5.8	6.7	8.2
Law	10,622	28.7	19.1	17.9
Social Sciences	3,191	2.9	7.6	12.7
Fine Arts	1,273	1.8	3.9	3.6
Humanities	2,558	3.7	6.6	7.9
Education	2,538	3.6	6.9	7.7
		100.0	100.0	100.0
Total number of degree holders	45,483	21,921	8,540	15,022

Note:

[a]Percentages may not add to 100.0 because of rounding.

Source:

Recursos y Requerimientos de Personal de Alto Nivel; Colombia: 1964-1975, Instituto Colombiano de Especializacion Tecnica en el Exterior (ICETEX), Tolleres Graticos del Banco de la Republica, Bogota, Colombia, Table V-9.

Table B-4

MEASURES OF PROFESSIONAL MANPOWER AND COMPOSITION OF ENROLLMENT IN HIGHER EDUCATION IN SELECTED COUNTRIES

Country	Number of Professionals per 10,000 Population		Orientation of Higher Education (percent enrolled)		Educational Expenditures as Percent of National Income
	Engineers	Physicians and Dentists	Science and Technology	Humanities, Law and Arts	
USA	61.7	18.0	22.7	n.a.	4.6
USSR	48.1	16.7	45.3	7.6	7.1
Japan	n.a.	13.5	22.1	26.6	5.7
Israel	n.a.	27.5	42.3	50.4	3.0
Denmark	49.9	15.5	20.4	17.5	2.9
Taiwan	30.0	3.6	39.6	25.1	3.3
Egypt	5.0	4.6	24.0	35.2	3.7
Mexico	n.a.	4.5	18.3	8.1	1.4
Colombia	3.6[a]	5.0	32.7	39.8	2.1
Brazil	n.a.	5.0	18.6	39.1	2.6
Guatemala	n.a.	1.2	23.7	33.6	2.4
Kenya	.87	1.1	21.6	6.2	3.3
Tanganyika	.36	.5	n.a.	n.a.	3.0

Notes:

n.a. -- not available.

[a]Based on ICETEX data for 1964 presented in Table B-3.

Source:

Frederick Harbison and Charles Myers, Education, Manpower and Economic Growth, McGraw-Hill, New York, 1964, Table 5, p. 45. Countries are listed by descending order of their composite index of educational resources as derived by Harbison and Myers.

Table B-5

MIGRATION OF PROFESSIONALS, TECHNICAL AND KINDRED WORKERS FROM VARIOUS COUNTRIES IN LATIN AMERICA TO THE UNITED STATES

Country	Graduates of Institutions of Higher Education, 1960	Immigrant Visas of Professionals and Technical Workers to U.S., 1962-1964	Average Annual Number of Immigrant Visas, 1962-1964, as Percent of Graduates, 1960
Argentina	166,310	1,864	.37
Brazil	95,962	933	.32
Colombia	32,733	1,578	1.61
Costa Rica	4,703	456	3.23
Chile	26,900	467	.58
Ecuador	9,361	662	4.71
Mexico	88,150	2,304	.87
Peru	29,270	650	1.50
Uruguay	21,080	86	.14
Venezuela	24,320	984	1.35

Sources:

Column 1 from ICETEX study, Table V-4 (see citation in Table B-3; Column 2 from Migration of Health Personnel, Scientists and Engineers from Latin America, Pan American Health Organization, World Health Organization, Washington, D.C., 1966, Appendix II, Tables A-B-C.

Table B-6

MEDIAN FAMILY INCOME IN COLOMBIA BY RESIDENCE AND EDUCATION, 1965-1966[a]
(in pesos)[b]

Educational Attainment of Head of Household	Residence		Difference Between Urban and Rural
	Urban	Rural	
None	5,139	3,043	2,105
Primary	7,162	3,401	3,761
Secondary	12,949	6,088	6,861
College	30,432	22,342	8,091

Notes:

[a]Based on National Health Survey findings from a stratified probability sample of the noninstitutional population of Colombia. Interviews totalled 9,600 dwellings, representing 52,500 persons.

[b]The value of the peso fluctuated between 11 and 9 pesos to the dollar during the period of the Survey.

Source:

Social Science and Health Planning: Culture, Disease and Health Services in Colombia, Milbank Memorial Fund Quarterly, Vol. 46, No. 2 (April 1968), Part 2, Appendix B, Table 2, p. 336.